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SUMMARY REPORT  
1953

RESEARCH ON OPERATIONAL  
FEASIBILITY OF SCATTER  
PROJECTILES

Ex-365  
REPORT NO.

8/26/54  
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SUMMARY REPORT

1953

RESEARCH ON OPERATIONAL FEASIBILITY OF  
SCATTER PROJECTILES

I INTRODUCTION

The objective of the work on contract Nonr-555(00) reported herein has been to continue research and studies concerning the operational feasibility of scatter projectiles. The research has been confined to scatter projectiles of a size which are suitable for ultimate use in a 20 MM round or a standard 12 gage shotgun.

During this research, the aim of the program was to establish the feasibility of 20 MM and 12 gage shotgun ammunition which would have a distribution of 80% of the projectiles in a six foot diameter at 100 yards range. In addition to distribution, consideration was given to other phases of the problem leading to a pre-prototype round, such as feasibility of manufacturing all of the ammunition components.

During the past year considerable progress has been made in manufacturing better projectiles at reduced cost. The techniques currently being used can readily be adopted for the manufacture of large production quantities of projectiles.

Projectiles are cold forged by use of a die set which is installed in a punch press and each complete cycle of the press produces a finished projectile. (See photographs on pages 3, 4 and 5). During the process of arriving at the final coining die material, die life ranged from 20 projectiles to hundreds.

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Finally two die materials were arrived at whose die life ranges into thousands of projectiles. These die materials are AIRDI No. 150 made by the Crucible Steel Company and Hampden Tool Steel made by the Carpenter Steel Company.

In addition to die material development, one of the greatest problems was to arrive at a suitable material for making the projectiles. The original projectiles were made of wire having a low carbon content and because of the setback loads on the projectiles encountered during firing it became necessary to harden them. With the material being used, it was only possible to case harden the projectiles and this resulted in poor uniformity since it was found that they ranged from soft to extremely brittle. The final material selected was supplied by the Bethlehem Steel Company of Baltimore, Md. and is of a type that may be heat treated. Use of this wire resulted in very uniform projectiles which, when fired, remained intact. The material is .088 diameter, 1060 steel wire which is spherodized, annealed, cleaned and bethalube coated to finish size. Formed projectiles are heat treated to an ultimate tensile strength of 190,000 psi.

Progress is steadily being made regarding reduction of manufacturing costs of the sabots. However, until such time that the final sabot configurations may be set, it will not be possible to establish cost data.

As may be seen from the curve on page 6 of this report, accuracy of the heat treated projectiles was greatly improved over the low carbon steel case hardened type fired in the beginning of this program. The comparison is made only on projectiles having canted fins since they in turn were better than the projectiles not having canted fins. The improvement results from the greater uniformity and reduction of heat treating distortions.

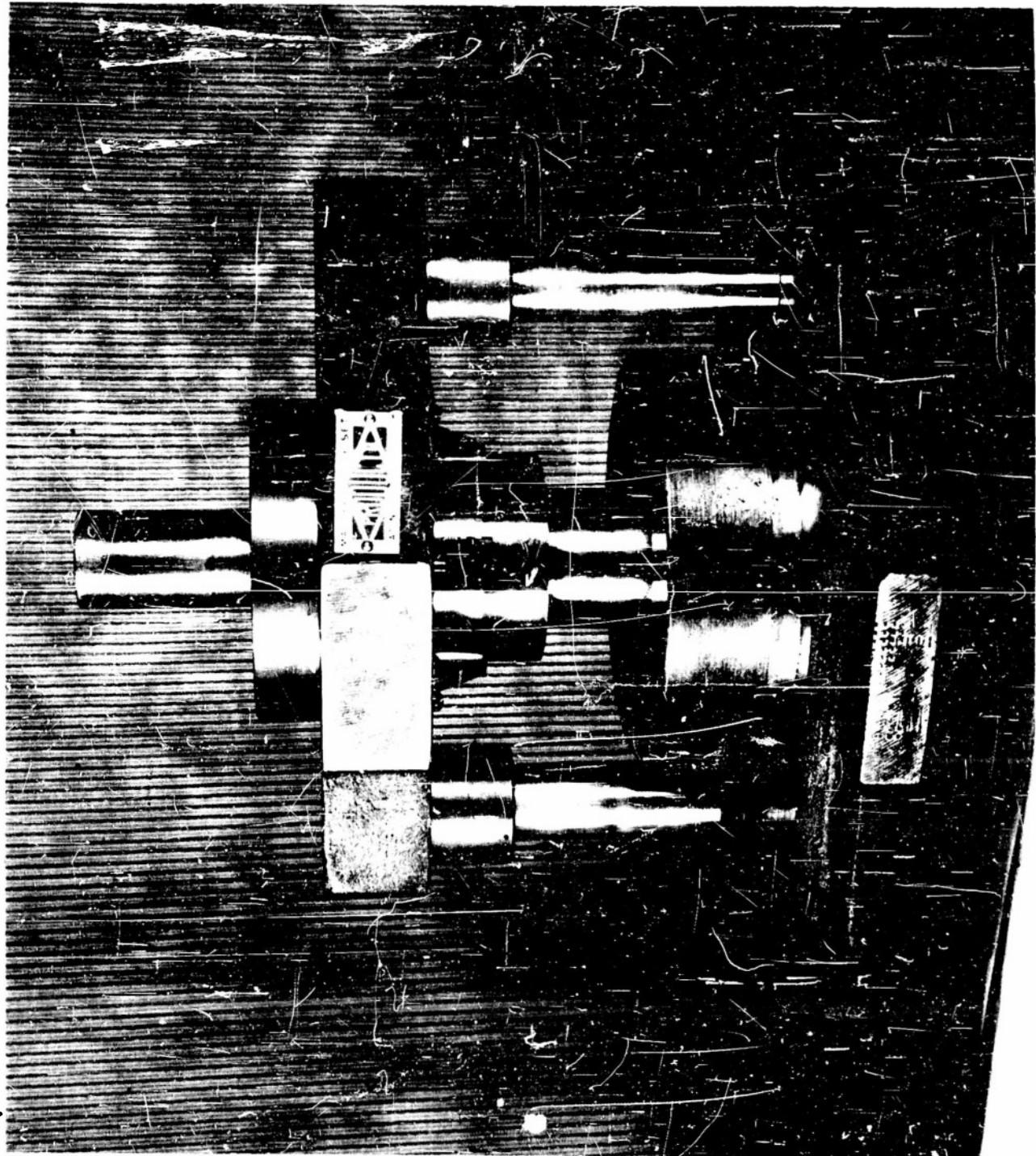
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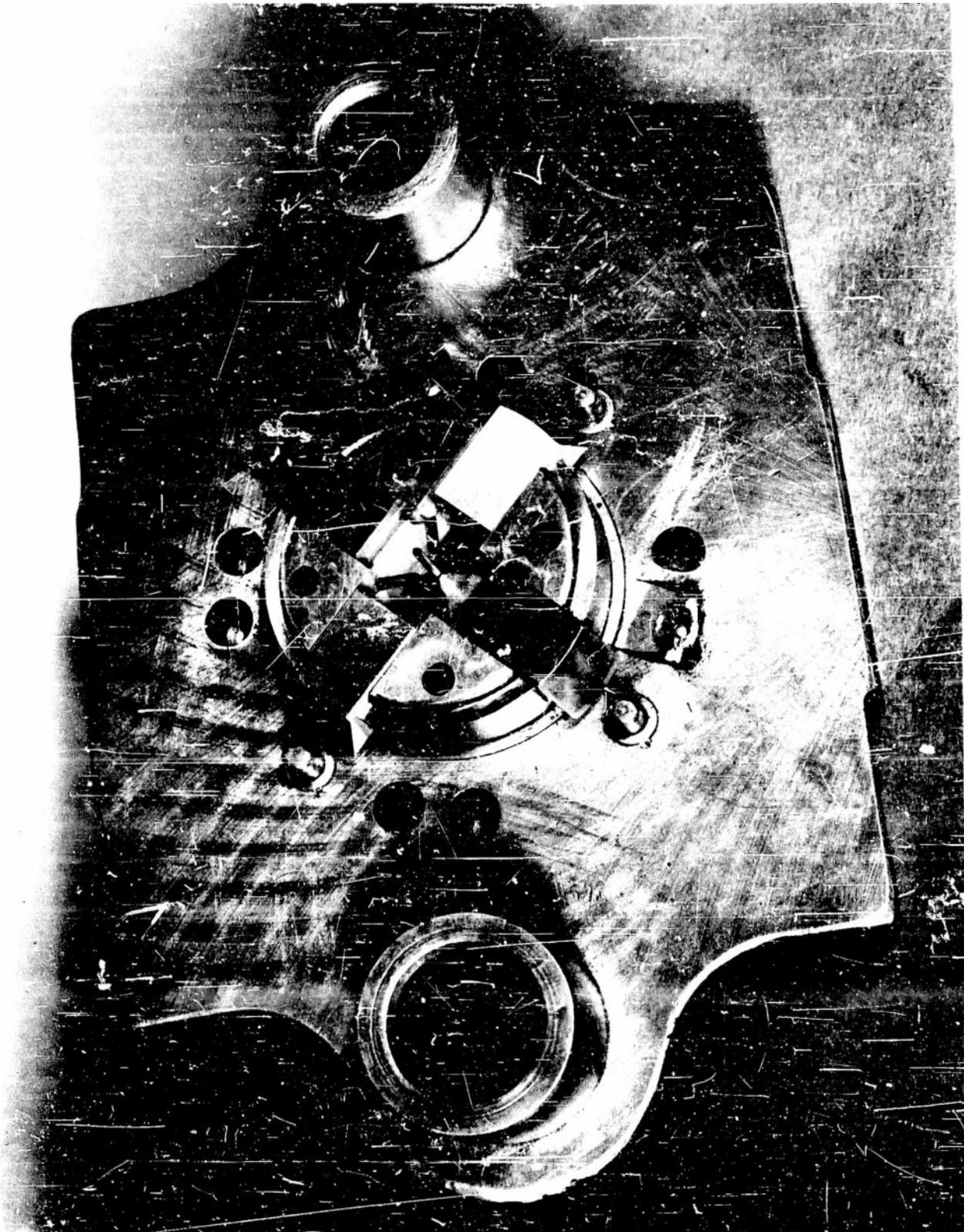
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DIG. S/T SHOT

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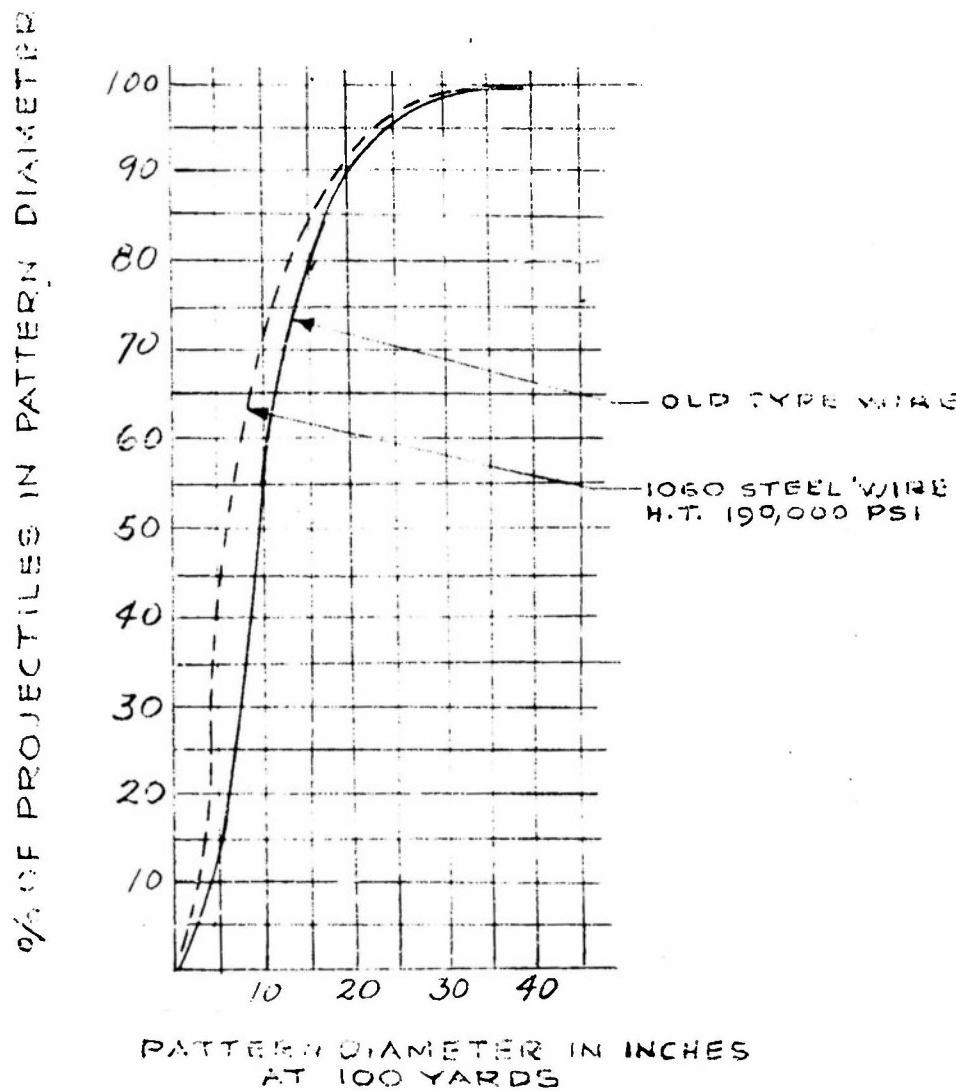


PIP SET AND PROJECTILE

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20 MM PROJECTILES  
SINGLE LAUNCHINGS  
TWISTED OR CANTED FINS



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## II. SINGLE PROJECTILE DEVELOPMENT

### A. Purpose

To develop a projectile suitable for multiple firing with the following characteristics:

1. Capable of taking set-back force without deforming.
2. Stable under normal launching conditions.
3. Having accuracy suitable to fulfill characteristics discussed in the introduction.
4. Capable of being manufactured accurately in quantity.
5. Capable of being packaged as a round.

### B. Studies

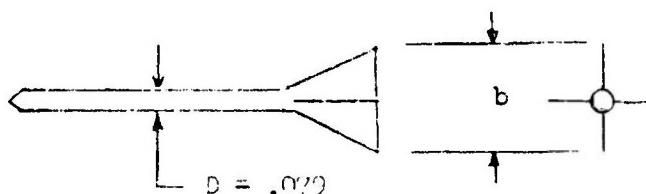
Ballistic and aerodynamic studies were made in the beginning of the program (Reference 'b') and additional studies were conducted as required during testing.

### C. Tests

A test program was set up to establish the above characteristics and the projectiles were fired in the following manner:

#### 1. Nos. 1 to 9 (Delta Fins)

These projectiles were fired during 1952 to establish the minimum span required to give a stability sufficient to continue further tests. The spans varied from .108 in. to .150 in.



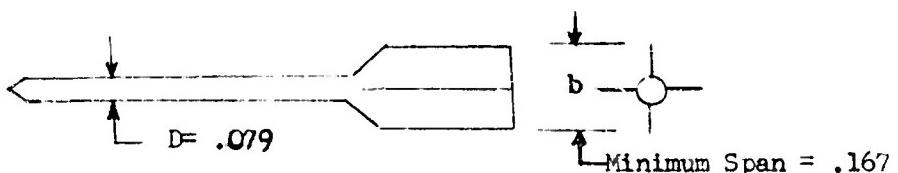
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These projectiles were made up by slotting the base and silver soldering fin inserts in place. The minimum span found to give any stability was .144 inches or b/D ratio of 1.82 for this configuration.

2. Nos. 10 to 23 (omitting Nos. 14 and 15 which were different types)

These projectiles had rectangular fins and their spans varied from .113 in. to .200 in. They were fired to establish minimum span.

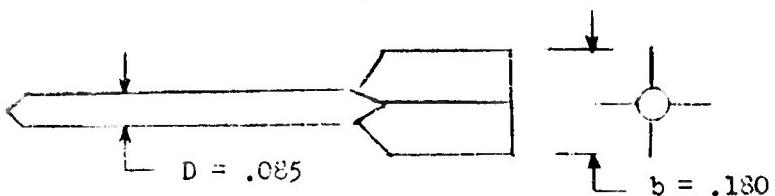


A minimum span or b/D ratio of 2.11 was found to be stable. The number of tests were limited due to the fact that the projectiles were handmade. Work then continued to establish a method of forming projectiles in quantities so that statistical results could be obtained. They were made on the forging machine described on page 1 of this report.

3. Rounds 24 through 30

The b/D ratio established previously was used in these tests:

$$b/D = 2.12$$



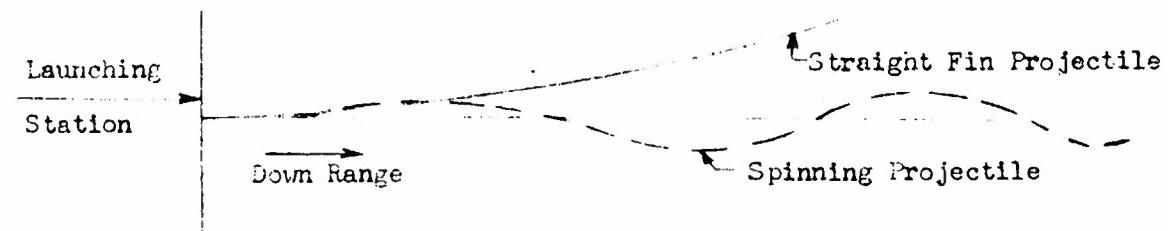
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The change in diameter was made in order to use wire available for machine forming. These projectiles were stable as measured by accuracy and no attempt was made to improve that accuracy. Most of the erratic results in accuracy were traced to the method of manufacture and heat treatment of the projectiles.

#### 4. Straight Fin Projectiles Vs Spinning Projectiles

It may be seen from the plot of the 20 MM single launchings (page 12) that the percentage of projectiles hitting in a given diameter is much higher for the spinning type than for the straight fin projectile. This is due to the fact that manufacturing defects have less effect on a spinning projectile. Typical flight paths of the two types of projectiles is shown below in the non-dimensional graph.



The straight fin projectile tends to follow a curved path while the spinning projectile tends to follow a basically straight path.

#### 5. Determination of Preferred Single Projectile

Approximately nine different types of projectiles were fired of both the 20 MM and the shotgun type to determine the best one to be used for future testing. Quantities of the different types fired ranged from 8 of one type to 98 of another. It may be noted from the charts on pages 13 and 14

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that the  $2^{\circ}$  machine formed 20 MM projectile was the best from an accuracy standpoint and that the  $1^{\circ}$  machine formed projectile was the most accurate in the shot gun type.

It was concluded after this testing that these projectiles were suitable for future multiple rounds. In order to reduce costs of manufacturing, the  $2^{\circ}$  machine formed projectile for both 20 MM and shotgun multiple firings was selected for future tests.

The photographs on pages 15 and 16 show a typical 20 MM and shotgun single projectile and sabot.

#### 6. Stability Tests

Several of the different types of 20 MM and shotgun projectiles were fired at the Naval Ordnance Laboratory who jointly with AIRCRAFT ARMAMENTS, INC. conducted various tests and determined the stability characteristics of the different projectiles. It was noted during this testing that there was little difference between the  $1^{\circ}$ ,  $2^{\circ}$  and  $3^{\circ}$  shotgun type projectiles whereas the  $2^{\circ}$  20 MM projectile proved best. More detail information on these tests may be obtained by referring to NAVORD Report No. 2778 (Reference 'a').

It is to be noted that improvement can be made in the stability characteristics of both the 20 MM and shotgun type projectiles and AIRCRAFT ARMAMENTS, INC. is currently making plans to manufacture and test with the Naval Ordnance Laboratory additional new type single projectiles. One of the changes recommended by the Naval Ordnance Laboratory is to increase the fin chord length.

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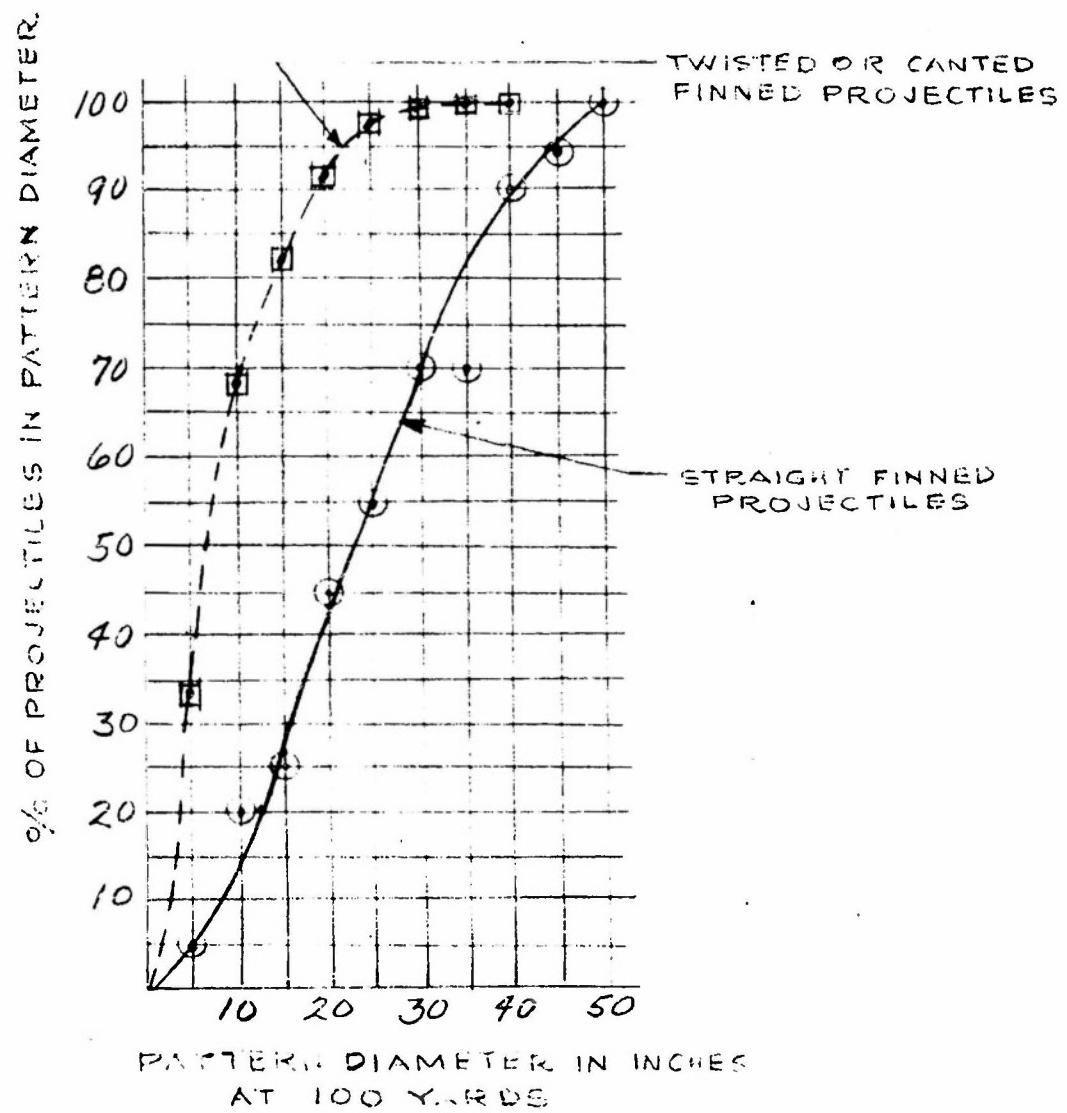
#### 7. Lethality Tests

After preliminary studies were made lethality tests were conducted at Edgewood Arsenal for both the 20 MM (21 grains) and shotgun (17 grains) single projectiles. A report of the findings is currently being prepared and should become available by April 1954. Preliminary indications are that these projectiles are lethal and have satisfactory penetrating power.

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20 MM PROJECTILES  
SINGLE LAUNCHINGS



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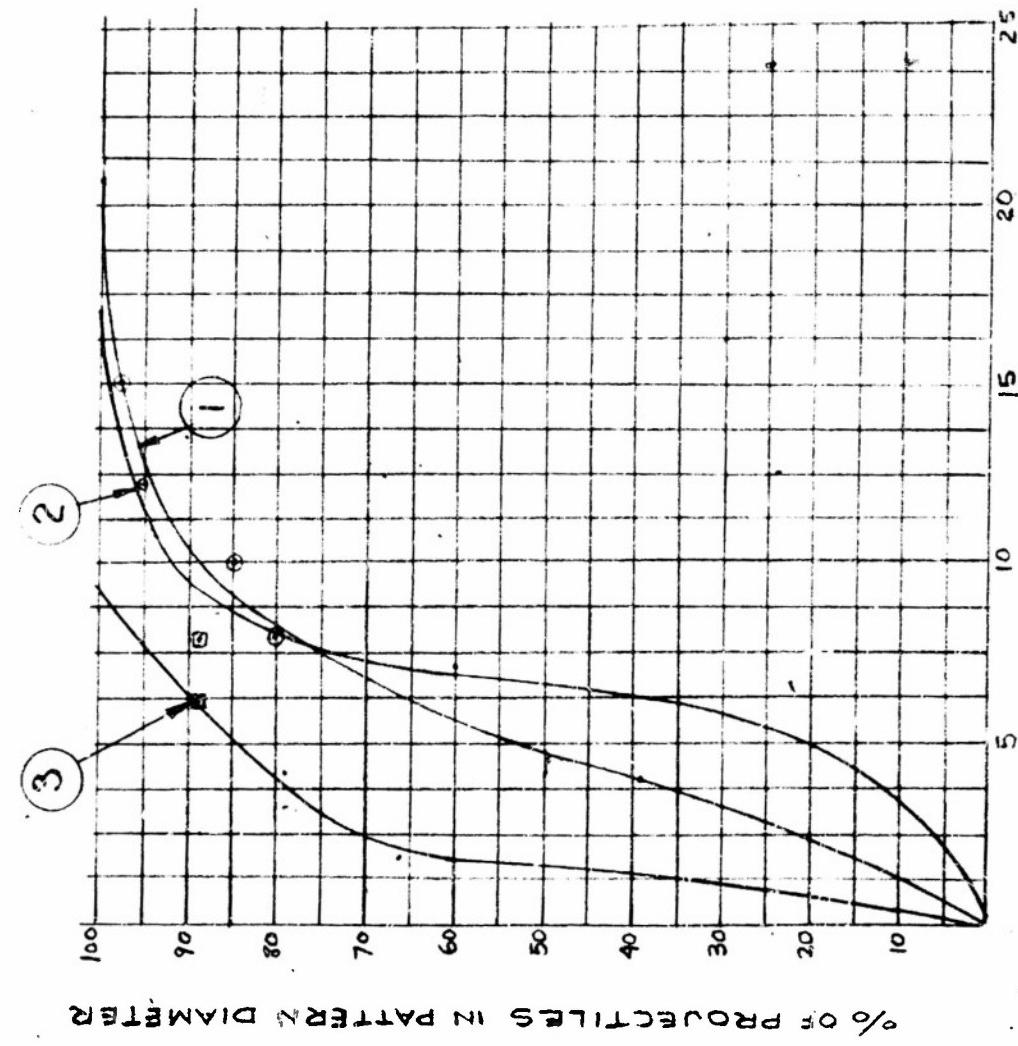
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SHOTGUN PROJECTILES  
SINGLE LAUNCHINGS

CURVE ENCLOSING 80% NO. OF PROJ. FIRED	PROJECTILE	FIN CANT	NUMBER ROUNDS FIRED
			10
		3° MACHINE FORMED	
	(1)		
	(2)		46
	(3)		9



PATTERN DIAMETER IN INCHES @ 100 YDS.

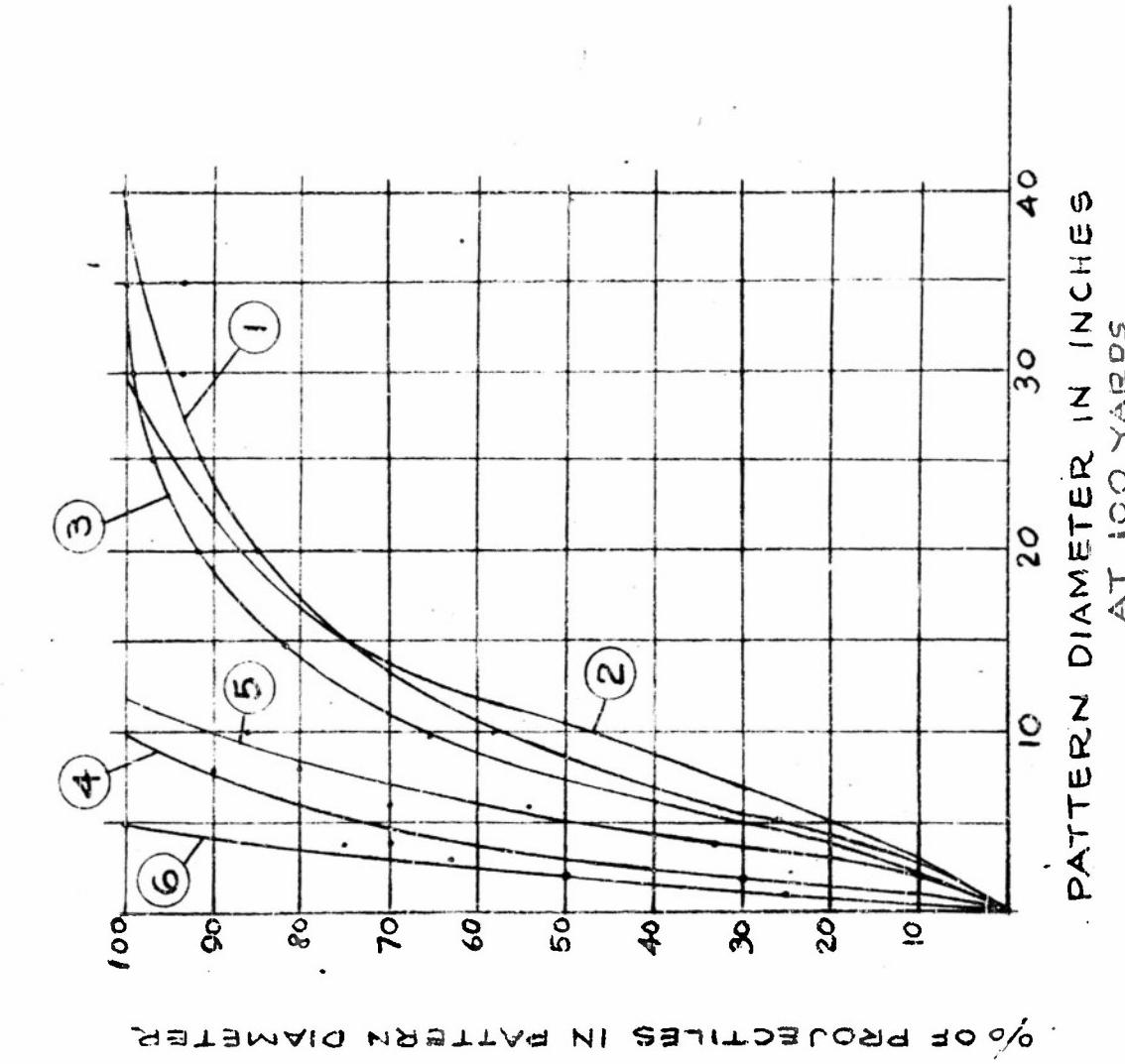
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20 MM PROJECTILES  
SINGLE LAUNCHINGS



CURVE NUMBER	DIAM. OF CIRCLE ENCLOSING 80% OF PROJ. FIRED	PROJECTILE	FIN CANT	NO. ROUNDS FIRED
1	17.8"	7° HAND TWISTED	43	
2	17"	7° MACHINE FORMED		15
3	14.5"	30° MACHINE FORMED		98
4	6.2"	20° MACHINE FORMED		10
5	8.5"	10° MACHINE FORMED		15
6	3.5"	20° MACHINE FORMED		8

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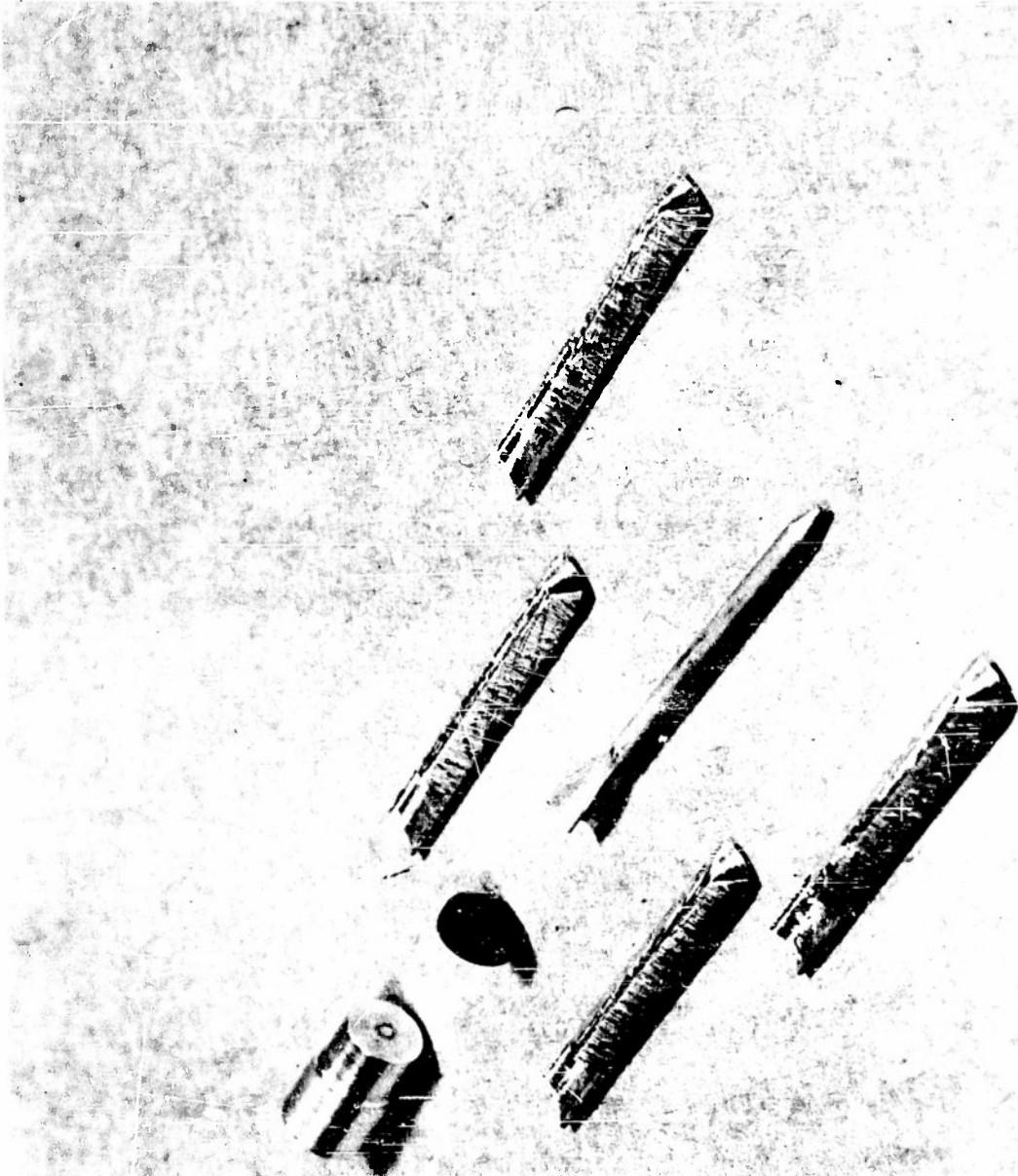
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SHOTGUN - SINGLE

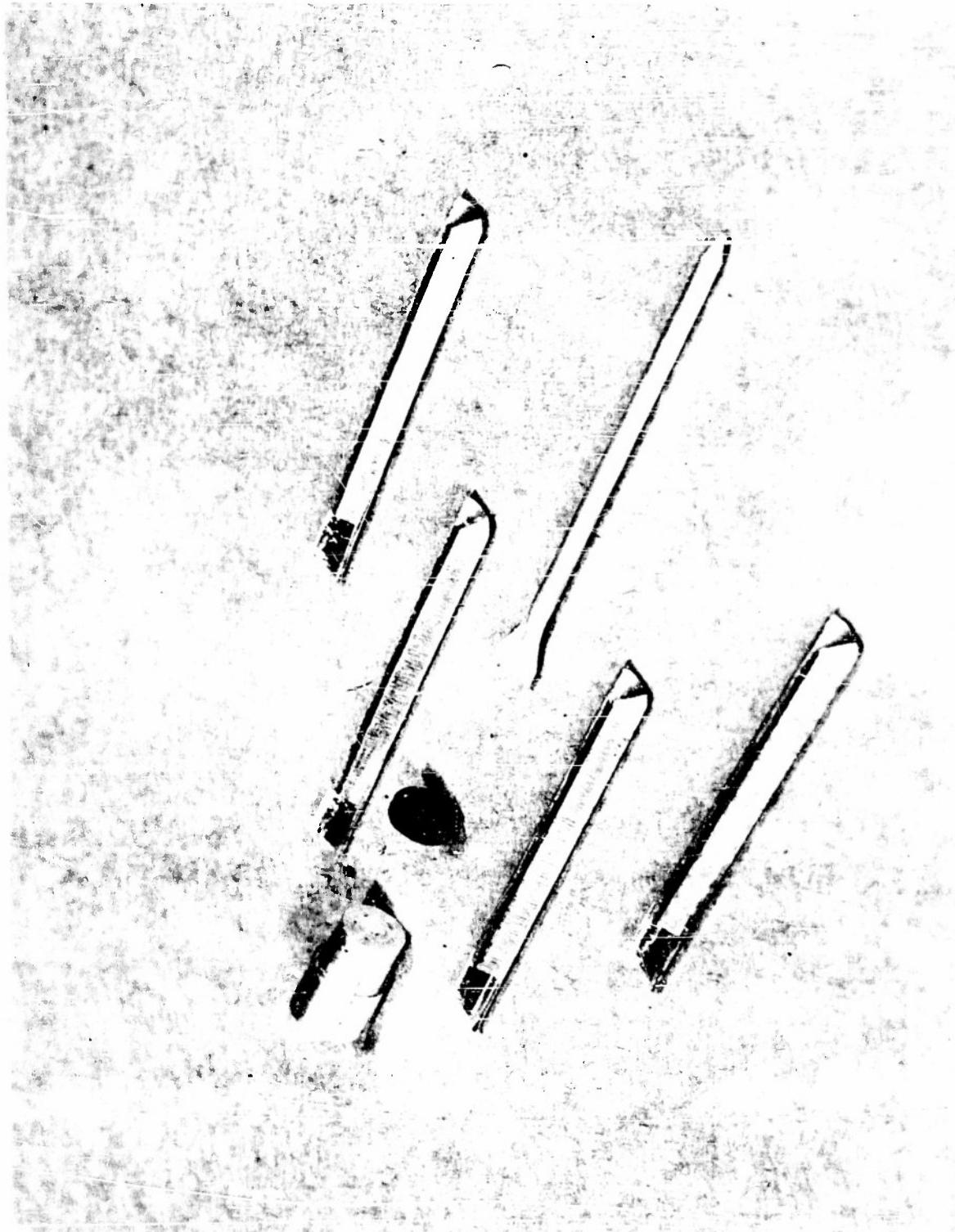
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20 MM - SINGLE

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### III. 20 MM CLUSTER ROUNDS

#### A. Gun Tube Design

1. The initial concept of firing scatter projectiles from a 20 MM barrel envisioned use of a special low twist rifled tube in order to achieve required dispersion of projectiles. Combined with this low twist barrel was a stripper attachment to accomplish break-up of the plastic sabot housing a number of fin stabilized projectiles.

Results obtained on the first series of test firings numbers 1 - 11 (ER-137, page 31 -Reference 'b') indicated the following:

- a. The stripper action was successful in that the sabot was broken up.
- b. The yaw card traces indicated poor stability of projectiles and few hits were recorded.

2. A study of these results indicated the following factors may have affected dispersion and lack of stability:

- a. The projectile fins were damaged due to acceleration loads in the gun.
- b. The stripper action may have been detrimental to projectile stability. (This might be indicated at a later date after further studies are made.)
- c. The tube twist due to rifling created high angles of yaw.
- d. The slotted back plate into which the projectile fins were placed caused damage to the fins.

3. It was decided to accomplish future firings using a smooth bore tube of .675 inch diameter and to do as much test firing as possible with a 12 gage smooth cylinder bore shotgun so that cost of the rounds would be reduced.

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The decision to use a smooth bore tube appears to be correct as a large number of rounds have subsequently been fired in both a 12 gage shotgun and a smooth bore 20 MM gun tube with considerable improvement in dispersion characteristics. Results are plotted on page 22 and do confirm this observation.

#### B. Sabot Design

Considerable experimentation on sabot design and packing medium has been conducted. The original firing (rounds Nos. 1 - 11) incorporated a plastic sabot which was intended to break up due to stripper action at the muzzle. The resulting dispersion was extremely high and consistent results could not be obtained. Upon review of the possible causes of this dispersion it was felt that the sabot break-up by stripper action may have disrupted the projectiles and that the heavy ballast plug pushing the sabot caused the projectiles to tumble.

For the 20 MM tests it was decided to use a standard 20 MM charge and projectile weight so as not to alter the internal ballistics of the gun. To obtain velocities of the order of 2800 feet/second it is necessary to have a total projectile weight of 2000 grains  $\pm$  50 grains.

Total weight with a maximum number of projectiles packed in a sabot (from 16 - 32 projectiles) was approximately 790 grains. This requires that a sabot and ballast must weigh approximately 1200 grains.

In order to distribute the mass so as to have the larger portion forward of the base plug, steel was substituted for plastic as the sabot material. This, of course, eliminated the use of a stripper for sabot

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separation and a new method of splitting the sabot into 4 segments was introduced. See photo on page 21 for typical 20 MM round.

Rounds Nos. 24 - 53 incorporated a split steel sabot of approximately 2 inch length and a 500 grain base plug. The results improved greatly as to dispersion and reasonable repeatability.

During this period various packing mediums were investigated. Wood fillers between projectiles were tried first and results appeared to be good. However, the inherent high cost of such packing methods led to experimentation with a frangible plastic type material. In addition, some indications were present that the wood filler strips interfered with proper cluster separation.

A few rounds using commercial rosin were fired and it was found that the rounds packed with rosin gave approximately the same results as when packed with wooden fillers. However, it was noted that the rosin had a tendency to adhere to the projectiles probably causing instability in flight. This was practically eliminated by zinc plating the projectiles. Rounds fired with zinc plating appeared to improve dispersion to some extent.

A limited number of photographs were obtained at the Naval Ordnance Laboratory and, although no conclusions were apparent, it was decided to investigate a number of sabot designs and packing methods. After firing these different configurations a selection for confirmation firing would be accomplished. NAVORD Report No. 2893 (Reference 'c') shows a photographic study of sabot separation of scatter projectile clusters.

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C. Results

Rounds Nos. 54 - 92 were fired and observation of data sketches shown on pages 22 and 50 will show that Type XII and Type H show best dispersion characteristics. (Approximately 9 projectiles in 6 foot diameter at 100 yards or a projectile density of .3 projectiles/square feet in a 6 foot diameter). Observation of data sheets on pages 24 and 25 and curves plotted on pages 22 and 23 will show graphically the firing results of this phase of the program to date.

D. Remaining Design Problems on Sabot

Additional studies should be made in order to increase the payload vs. the total weight of the round. This may be accomplished by utilizing a different powder charge and/or increasing the velocity, but requires variations in the interior ballistics of the gun. These changes were not desired to be incorporated at this stage of the investigation.

E. Lethality Studies

It is currently planned to conduct lethality tests at Edgewood Arsenal similar to those conducted on the single projectiles.

F. Wind Tunnel and Photographic Data

Studies and wind tunnel tests will be made at the Naval Ordnance Laboratory to determine the aerodynamic effects on the projectiles during cluster separation. In addition continued photographic studies will be made in order to establish possible sabot redesign so that better cluster separation may be obtained.

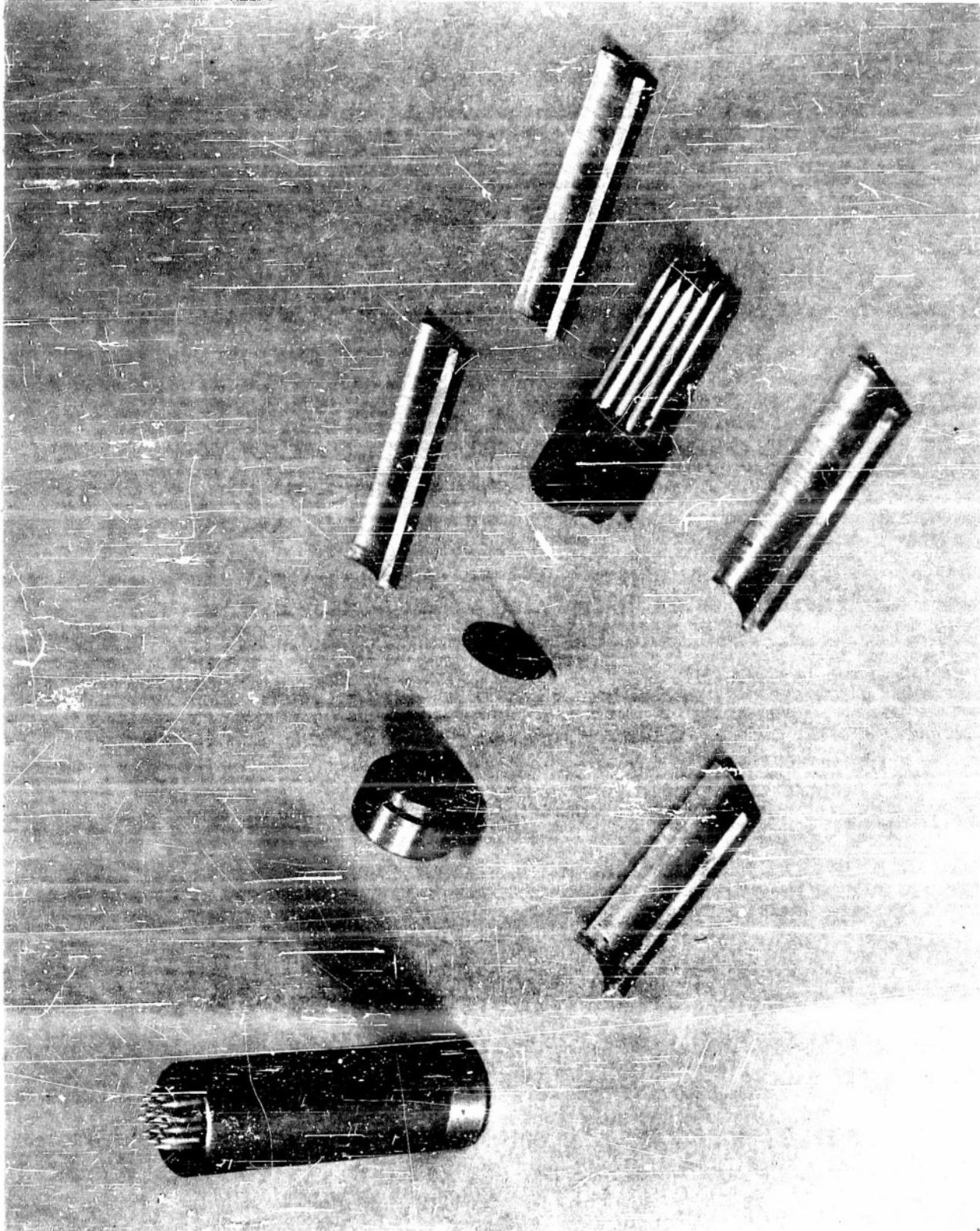
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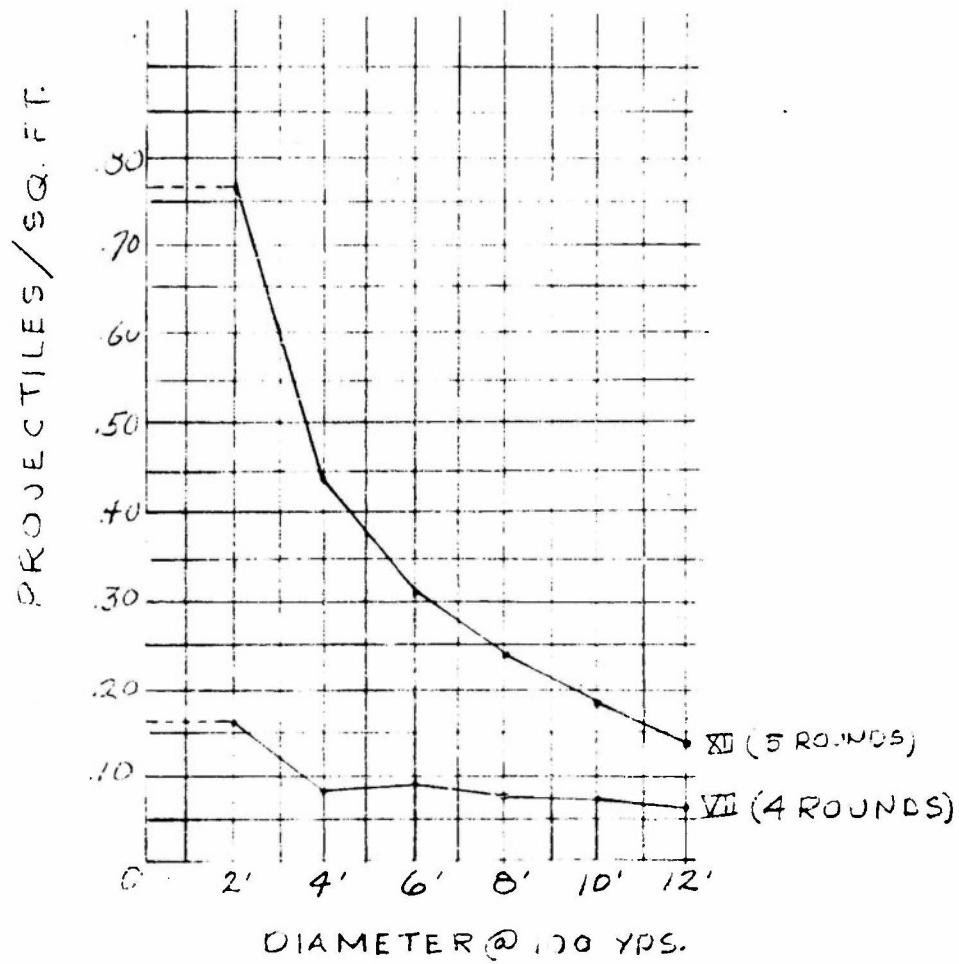


20 MM ROUND

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20 MM  
BEST & WORST OF ALL TYPES  
(BASED ON LARGER NUMBER OF  
ROUNDS FIRED)



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20MM Multiple Launch

Round Type Fired	Number of Rounds Fired	Number of Projectiles/ Proto-type Round	Fin Span	Fin Gant	Number of Projectiles in Diameter						Total Remarks	
					2 ft.	4 ft.	6 ft.	8 ft.	10 ft.	12 ft.		
A 6	21	No	.180	30	3	7	10	15	17	19	20	Best Average
B 3	21	"	.197	30	1	3	8	15	17	17	17	Best Average
C 4	21	"	.197	30	3	2.66	6.3	11.6	14.6	15.3	16	Best Average
D 2	21	"	.197	30	1	3.75	7.2	9.75	13.2	14.5	21	Best Average
E 3	21	"	.197	30	3	6	11	13	16	18	19	Best Average
F 4	21	"	.197	30	1	1.33	4	9	11	15	17	Best Average
G 3	21	"	.197	30	4	5	5	7.66	11.66	13	17	15.3 Average
H 4	21	"	.197	30	1.5	3.75	6.25	10.25	13	13.75	15	Best Average
I 5	42	"	.175	20	2	6	10	12	15	18	19	Best Average
XI 5	21	"	.200	20	2	8	2.8	5.	8.6	12.6	17.4	24.8 Average
XII 5	21	"	.200	20	5	8	11	14	18	20	21	Best Average
XIV 5	21	"	.200	20	2.4	5.6	8.6	12.2	14.2	16.2	18.2	Best Average
XV 5	21	"	.200	20	3	2.8	4.8	7	8.8	12.4	18	Best Average
XVI 5	21	"	.200	20	2	5	4.6	9	12	15	16	20 Best Average

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20MM. Multiple Launch

Round Fired	Number of Rounds	Number of Projectiles/Prototype	Fin Spur	Fin Cant	Number of Projectiles in Diameter						Total Remarks	
					2 ft.	4 ft.	6 ft.	8 ft.	10 ft.	12 ft.		
III	5	21	No	.200	2 <sup>0</sup>	3 1.6	7 4	11 6	12 7	13 9.2	16 11.6	21 20
VII	4	21	"	.200	2 <sup>0</sup>	3 .5	0 1	4 2.5	7 3.5	9 5.5	11 7	14 11.75
XVIII	5	22	"	.200	2 <sup>0</sup>	1 1	4 2.8	9 5.1	13 7.8	17 9.8	13 12.2	21 18.8
XIV	5	32	"	.200	2 <sup>0</sup>	2 1.6	8 3.6	12 8	16 12	19 15.6	21 17.6	28 26.4
XVII	4	21	"	.200	2 <sup>0</sup>	2 1	4 2	10 5	15 8.5	17 9.8	18 14	20 18.7

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IV. SHOTGUN (12 GAGE)

A. Purpose

During the course of 20 MM work it was found practical to utilize a 12 gage shotgun for preliminary evaluation of the type rounds to be used in 20 MM work. This decision was arrived at since it appeared that the costs of the total round would be cheaper and the use of a 12 gage shotgun would be less cumbersome than the 20 MM cannon.

While this was the prime reason for use of this caliber gun, it was later found during the course of the program that a weapon of this type would be an asset to the military and a joint program was conducted of both the 20 MM and shotgun type round; for that reason, more emphasis was placed on the 12 gage shotgun work than had originally been planned.

B. Sabot Design

The problems of the sabot design in the 12 gage shotgun were unlike those of the 20 MM cannon since, in order to utilize a standard charge, the total round weight could not exceed 600 grains and still maintain approximately 1450 ft/sec. It was found that the larger portion of the weight (approximately 480 grains) would be made up of projectiles (32 per round) and it became necessary to arrive at a sabot which would not exceed the remaining 120 grains. For this reason, plastic sabots were selected and in general the total round weight does not exceed 600 grains. These plastic type sabots appear to be inexpensive from the manufacturing standpoint since they lend themselves to molding practices and in addition their lightness should result in less disturbance to the final dispersion of the projectiles. Photographs of a launcher and a typical shotgun round are shown on pages 27 and 28.

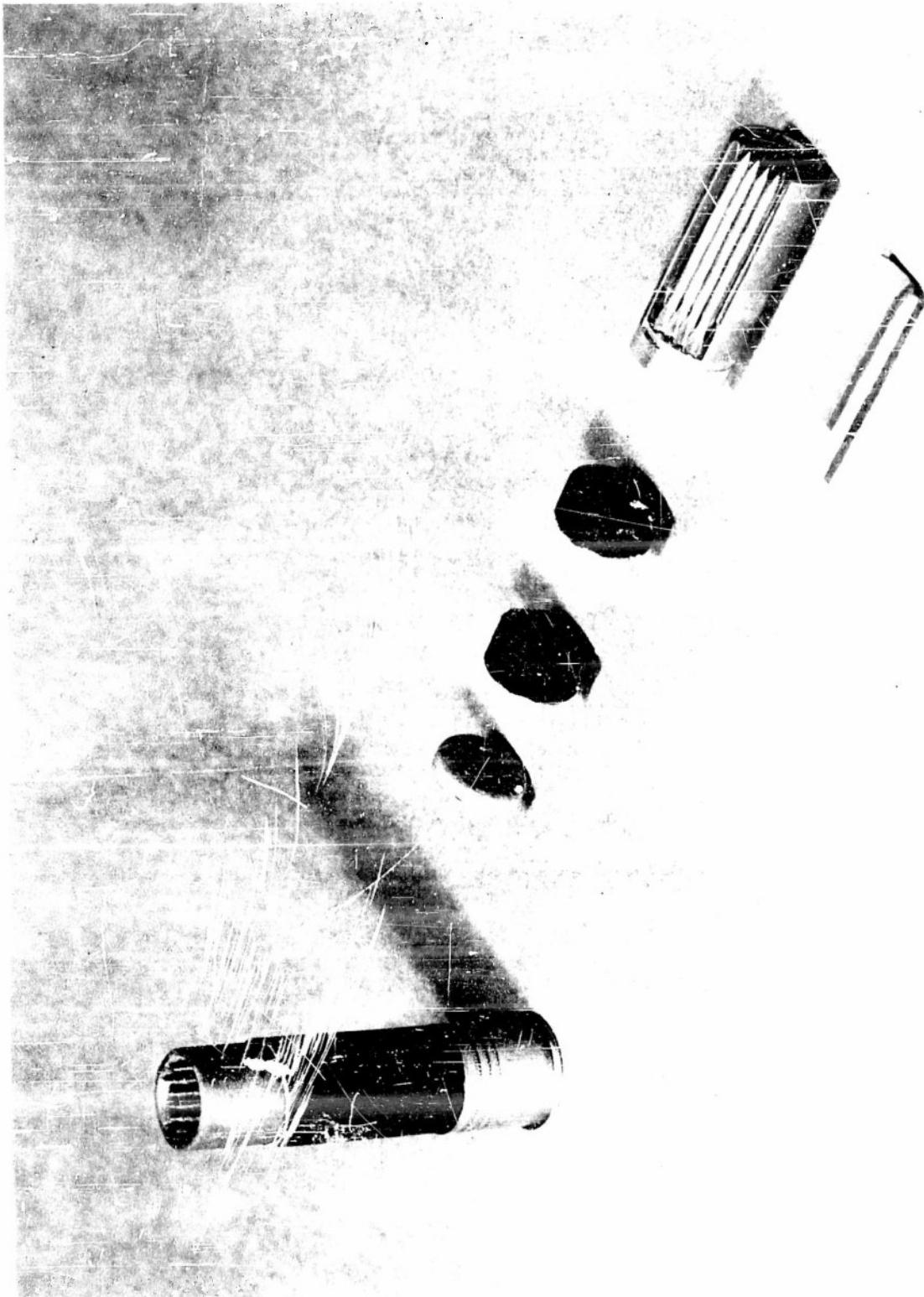
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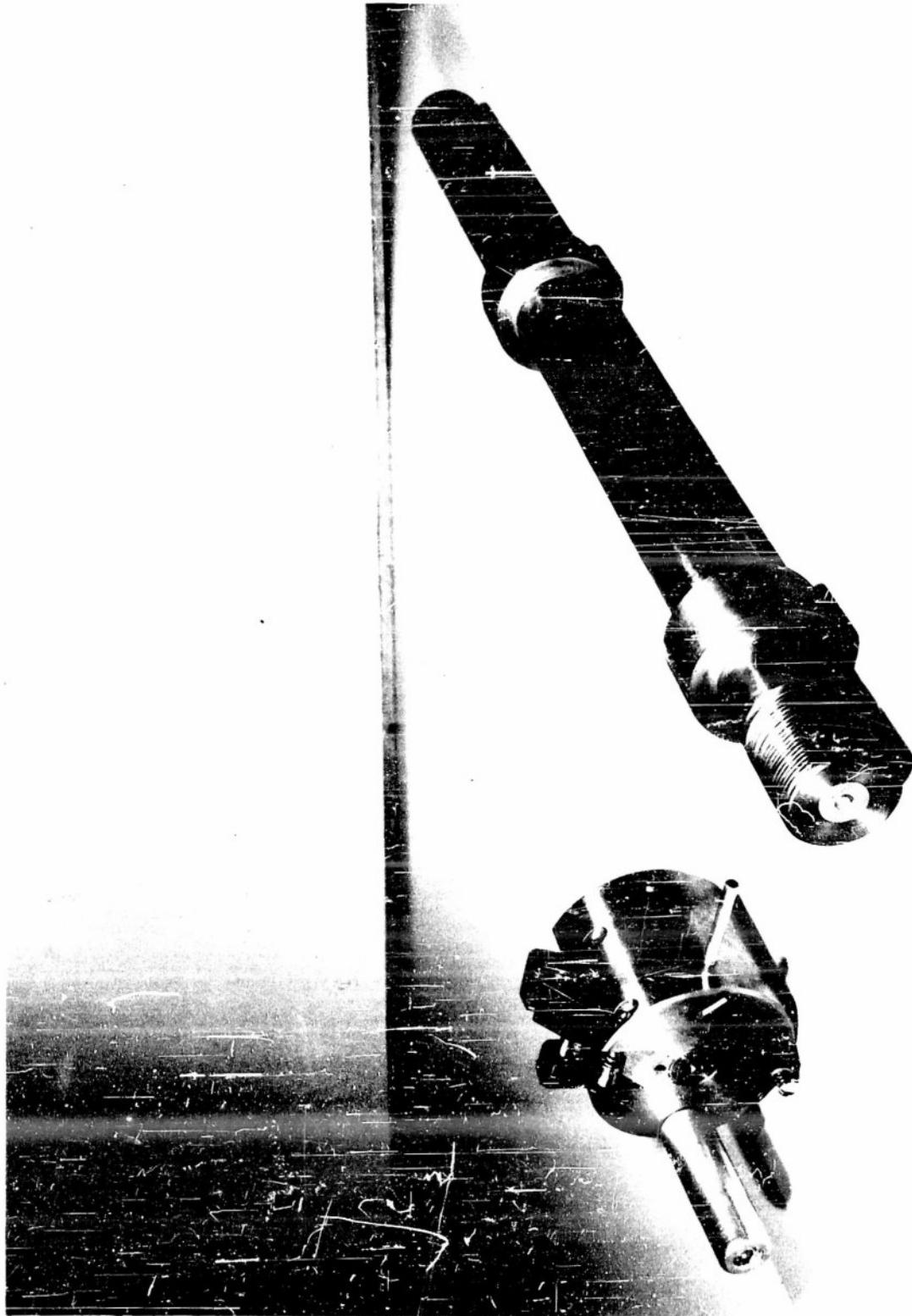
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SAC IN PLAIN ENGLISH

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C. Results

Observation of data sheets shown on pages 30 to 32 and curves plotted on pages 33 to 36 will show graphically the firing results of the program to date. It is not possible at this time to determine what rounds appear to be best and it is planned that additional firing of the better rounds incorporating some changes will be fired in the future. It may be noted, however, that round "J" shown on page 33 is an indication of what may be obtained when repeatability is accomplished.

D. Design Problems

Although it appears that the shotgun round is closer to a pre-prototype round, it is believed that this is only true from the packaging standpoint. One of the problems still remaining is that of producing a denser pattern. A study will be made to establish the criteria for this type of round and upon completion of this study, attempts will be made to obtain the proper round.

E. Lethality and Wind Tunnel Data

Similar studies and tests to those conducted for 20 M4 rounds have been and will be conducted on the 12 gauge shotgun rounds.

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12 Gauge Shotgun

Number Round Type Fired	Number Rounds Fired	Projectiles/Proto- type	Fin Span	Fin Cant	Number of Projectiles in Diameter						Total Remarks	
					2 ft.	4 ft.	6 ft.	8 ft.	10 ft.	12 ft.		
ER228- I	9	21	No	.150	20	1	3	6	8	9.5	11.5	13 Average Best
	9	21	No	.150	20	2	5	7	11	13	17	18 Best
ER228- II	49	21	No	.175	30	1	4	7	10.4	12.7	13.2	14.8 Average Best
	49	21	No	.175	30	2	7	14	21	21	21	21 Best
ER228- III	7	21	No	.160	20	.5	2	4.7	7	10	11.7	14.7 Average Best
	7	21	No	.160	20	1	5	10	13	16	16	19 Best
R	2	32	Yes	.150	20	.5	3	5.5	6.5	12	13.5	14.5 Average Best
	2	32	Yes	.150	20	0	2	7	7	13	15	16 Best
S	1	32	Yes	.150	20	1	4	4	4	7	8	9 Average Best
	1	32	Yes	.150	20	1	4	4	4	7	8	9 Best
T	2	21	Yes	.175	30	.5	2.5	4.5	9.5	10.5	15	16.5 Average Best
	2	21	Yes	.175	30	1	3	5	10	12	18	19 Best
U	2	21	Yes	.160	20	2	4.5	9.5	13.5	15.5	17.5	17.5 Average Best
	2	21	Yes	.160	20	4	4	10	14	17	19	19 Best
V	2	21	Yes	.150	20	.7	2.7	6.7	10	14	17	17 Best (Torn)
	2	21	Yes	.150	20	0	4	8	14	17	22	24 Best (Torn)
W	6	32	Yes	.160	20	.4	1.6	3.1	5.9	7.5	9.5	17.2 Average Best (Torn)
	6	32	No	.160	20	0	2	6	9	10	13	26 Best (Torn)
X	8	32	No	.160	20	.8	3.1	6.5	10.1	12.4	14.4	20 Average Best (Torn)
	8	32	No	.160	20	0	6	11	18	21	23	27 Best (Torn)
Y	8	32	No	.160	20	1.3	2.5	4.6	8	11	13	17.8 Average Best (Torn)
	8	32	No	.160	20	2	6	13	19	23	24	26 Best (Torn)

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12 Gauge Shotgun

Round Type	Number Fired	Number Rounds	Projectiles/Proto-type	Fin Span	Fin Cant	Number of Projectiles in Diameter				Total Remarks		
						2 ft.	4 ft.	6 ft.	8 ft.			
FII	2	26	Yes	.160	2°	.5	2	6.5	9.5	13.5	17	23.5 Average
	2	26	"	.160	2°	1	2	7	10	15	19	23 Best
ER228 - IV	3	21	No	.175	15°	0	3	-	3	11	11	11 Average
	3	21	"	.175	15°	-	-	-	17	17	17 Best	
ER228 - V	1	21	"	.175	0°	-	-	8	8	8	8	8 Average
	1	21	"	.175	0°	0	-	6	8	8	8	8 Best
I	2	21	"	.175	0°	-	2.5	5.5	5.5	5.5	5.5	5.5 Average
	2	21	"	.175	0°	-	-	6	6	6	6	6 Best
II	2	21	"	.175	70°	0	5.5	10.5	10.5	10.5	10.5	10.5 Average
	2	21	"	.175	70°	-	11	11	11	11	11	11 Best
III	4	21	"	.175	30°	-	12.7	12.7	12.7	12.7	12.7	12.7 Average
	4	21	"	.175	30°	-	17	17	17	17	17	17 Best
IV	3	21	"	.175	30°	-	-	7	-	-	-	- Average
	3	21	"	.175	30°	-	-	1.5	-	-	-	- Best
V	4	28	Yes	.160	2°	2	5	12	16	16	19	65 Best
	4	28	"	.160	2°	1	2.7	5.4	9	10.5	12.5	19.7 Average
VI	2	32	"	.160	2°	2	4	5	8	12	16	27 Best
	2	32	"	.160	2°	1.5	3	4	7.5	10.5	15	22.5 Average
VII	2	32	"	.160	2°	1	5	7	11	16	16	28 Best
	2	32	"	.160	2°	.5	4	8	10.5	14	15	28.5 Average
VIII	3	21	No	.175	30°	-	17	17	17	17	17	17 Average
	3	21	"	.175	30°	-	17	17	17	17	17	17 Best

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12 Gauge Shotgun

Round Type	Number Fired	Number Rounds	Projectiles/Prototype	Fin Span	Fin Cent	Number of Projectiles in Diameter					Total Remarks
						2 ft.	4 ft.	6 ft.	8 ft.	10 ft.	
D	12	32	Yes	.160	2°	1.4	3.7	6.9	10.2	13.4	25 Average (Torn) Best at 50 yds. Best at 100 yds.
	12	32	"	.160	2°	4	8	17	26	29	32
	12	32	"	.160	2°	3	9	19	23	25	31
F	1	32	"	.160	2°	0	1	2	6	9	11 Average Best (Torn)
	1	32	"	.160	2°	0	1	2	6	9	11
G	1	32	"	.160	2°	1	5	8	12	12	14 Average Best (Torn)
H	1	32	"	.160	2°	1	4	10	14	14	14 Average Best (Torn)
J	2	32	No	.160	2°	3	6.5	13.5	22	28.5	32 Average Best at 50 yds.
K	3	32	Yes	.160	2°	4	2.7	5	7.3	8.6	10.7 20.7 Average Best
L	6	32	No	.160	2°	2	1.3	3.7	7.2	10.2	13.5 22.2 Average Best
M	3	32	Yes	.160	2°	1	3	9	13	15	15.7 24 Average Best (Torn)
N	3	32	"	.160	2°	1	4	6	10.7	12	16 26.3 Average Best
P	9	32	"	.160	2°	3	3.8	7.7	10.8	15.0	18.0 31 Average Best
T	9	32	"	.160	2°	3	7	11	16	18	24

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8'-22 PROJ.  
10'-28½ PROJ  
12'-32 PROJ.

P1  
QL  
AEP2

D

H

M

N

O

I

B

G

R

C

T

3

H

F

K

E

S

12 GA. SHOTGUN  
MULTIPLE ROUNDS

NUMBER OF PROJECTILES

15

10

5

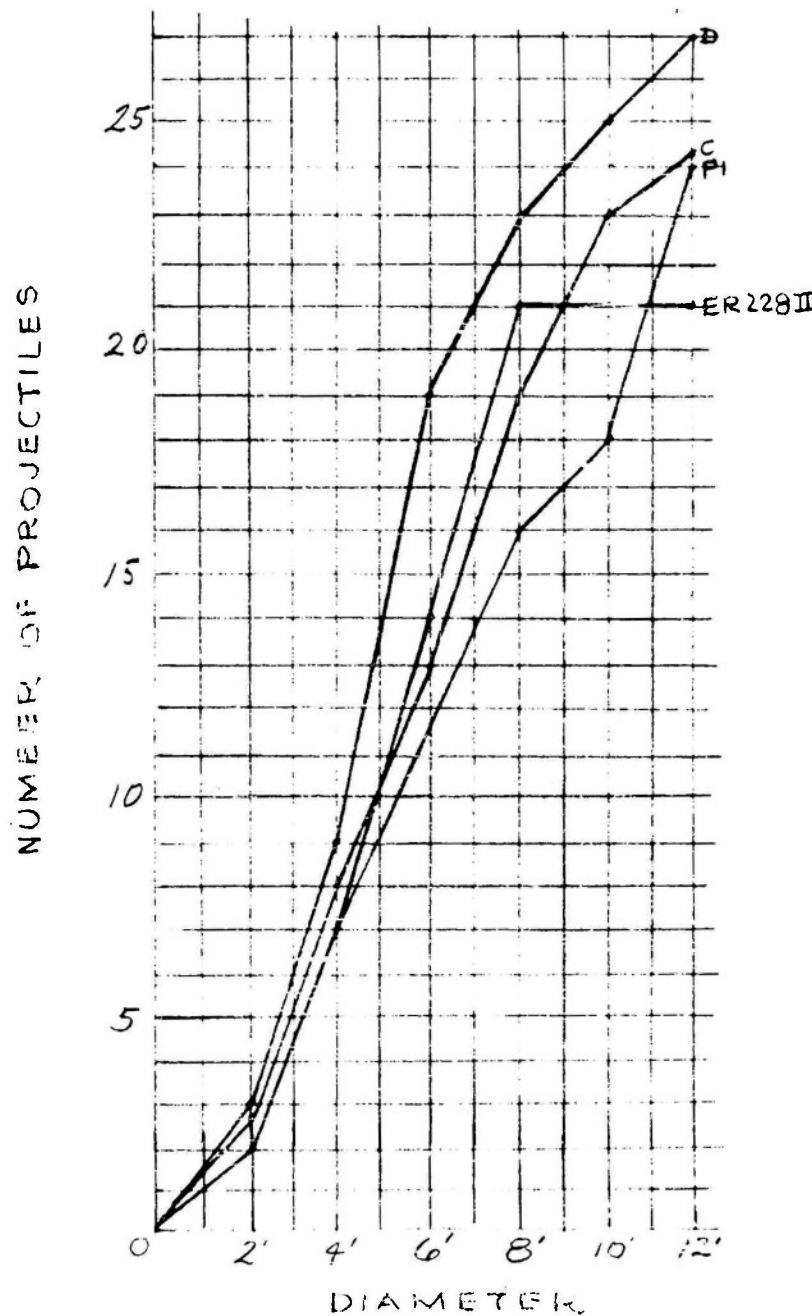
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DIAMETER AT 100 YARDS

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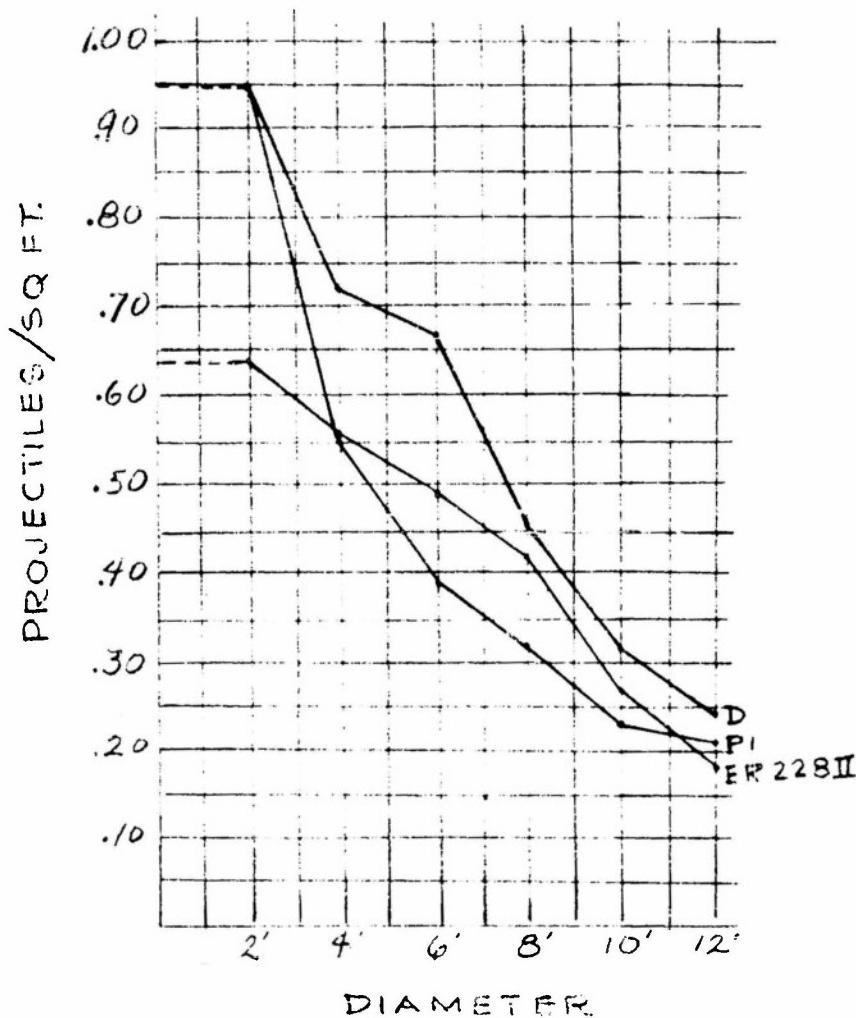
12 GAUGE SHOTGUN MULTIPLE ROUNDS  
AT 100 YARDS  
(BEST SINGLE ROUND OF EACH TYPE)



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12 GAUGE SHOTGUN MULTIPLE ROUNDS  
AT 100 YARDS  
(BEST SINGLE ROUND OF EACH TYPE)



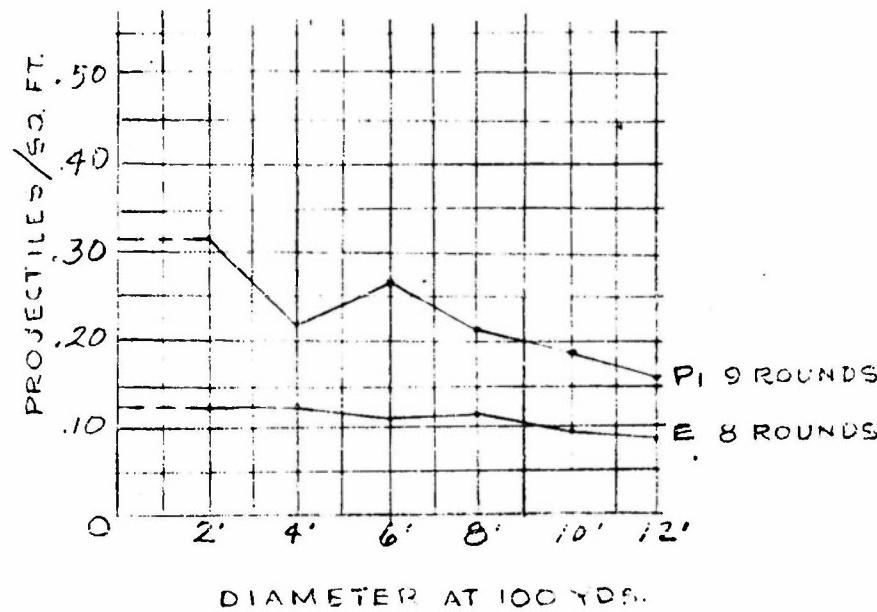
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12 GA. SHOTGUN MULTIPLE ROUNDS @ 100 YARDS  
BEST AND WORST OF ALL TYPES  
BASED ON LARGEST NUMBER OF ROUNDS FIRED



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## V . CONCLUSIONS

The following conclusions are drawn as a result of the work under the subject contract during the past year:

1. Work to date indicates that scatter type ammunition is feasible and can be developed into a tactical ammunition. Additional data is required to establish the limitations of such possibility.
2. Additional investigations are required to establish:
  - a. Lethality characteristics.
  - b. Means to increase lethality of multiple rounds.
  - c. Detail design of ammunition.
  - d. Repeatability.
  - e. Proper sabot separation.
  - f. Lower costs of manufacturing components.
  - g. Better manufacturing technique.

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## VI FUTURE PROGRAM

It is currently planned that the future program for the year 1954 will be as follows:

A. Establishment of Ammunition Criteria

1. Analysis of required performance.
2. Comparison with existing weapons.

B. Shotgun

1. Single Projectiles
  - a. Engineering design.
  - b. Manufacture of test articles.
  - c. Preliminary tests.
  - d. Determination of characteristics at the Naval Ordnance Laboratory.
  - e. Lethality studies at the Army Chemical Center.

2. Multiple Rounds

- a. Engineering design.
- b. Manufacture of test articles.
- c. Preliminary tests.
- d. Determination of sabot breakaway characteristics at the Naval Ordnance Laboratory.
- e. Lethality studies at the Army Chemical Center.

C. 20 MM

Same as B.1.c, B.1.d and B.1.e above.

D. Summary Reports

1 July 1954 and 31 December 1954.

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VII. REFERENCES

- Reference: (a) NAVORD Report No. 2778, dated 10 February 1953,  
"A Free Flight Range Investigation to Determine  
the Stability Characteristics of Individual  
Scatter-Type Projectiles".
- (b) AIRCRAFT ARMAMENTS, INC. Report No. ER-137,  
dated 30 June 1952, "Research on Operational  
Feasibility of Scatter-Type Projectiles".
- (c) NAVORD Report No. 2893, dated 9 June 1953,  
"Photographic Study of Sabot Separation of  
Scatter Projectile Clusters".

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VIII. APPENDIX

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SINGLE PROJECTILES

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
1	.079	2.25	Delta	.109		Not Available	Not Available
2	"	2.25	"	.114	"	"	"
3	"	2.24	"	.117	"	"	"
4	"	2.38	"	.144	"	"	"
5	"	2.38	"	.147	"	"	"
6	"	2.20	"	.150	"	"	"
7	"	2.20	"	.150	"	"	"
8	"	2.06	"	.108	"	"	"
9	"	2.38	"	.123	"	"	"
10	"	2.26	Rect. Length .312	.113	"	"	
11	"	2.26	" .319	.116	"	"	
12	"	2.34	" .317	.184	"	"	
13	"	2.25	" .250	.195	"	"	
14	"	1.92	" .140	.156	"	"	
15	"	2.38	" .250	.160	"	"	3 fins
16	"	"	" .250	.164	"	"	
17	"	"	" .312	.200	"	"	
18	"	2.25	" .250	.161	"	"	
19	"	2.25	" .250	.161	"	"	
20	"	2.06	" .265	.180	"	"	
21	"	"	" .197	"	"	"	
22	"	"	" .167	"	"	"	
23	"	"	" .177	"	"	"	
24	.085	"	" .285	.180	"	"	
25	"	"	" "	"	"	"	
26	"	"	" "	"	"	"	
27	"	"	" "	"	"	"	
28	"	"	" "	"	"	"	
29	"	"	" "	"	"	"	
30	"	"	" "	"	"	"	
31			Delta	.170	"	"	fired into cotton waste
32	No Record	No Record	Rect.	.217	5 in.	100 ft.	
33			Delta	.168			
34	"	"	Delta	.171			
35	"	"	Rect.	.214	7 in.	100 yd.	
36	"	"	"	.203	6 in.	100 yd.	
37	"	"	"	.215	11.5 in.	50 yd.	
38	"	"	"	.206	10 in.	100 ft.	
39	"	"	"	.216	8 in.	200 ft.	
40	"	"	"	.211	10 in.	75 ft.	

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SINGLE PROJECTILES (con't.)

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Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
41	No Record	No Record	Rect.	.209	15 in.	50 yd.	
42	"	"	"	.214	6 in.	50 ft.	
43	"	"	"	.213	2 in.	100 yd.	
44	"	"	"	.220	11 in.	200 ft.	
45	"	"	"	.211	6 in.	50 ft.	
46	"	"	"	.227	6 in.	100 yd.	
47	"	"	"	.211	7 in.	125 ft.	
48	"	"	"	.209	9 in.	75 ft.	
49	"	"	"	.210	12 in.	50 yd.	
50	"	"	"	.203	8 in.	50 ft.	
51	"	"	"	.174	10 in.	100 ft.	
52	"	"	"	.175	8 in.	75 ft.	
53	"	"	"	.173	11 in.	100 ft.	
54	"	"	"	.175	12 in.	50 yd.	
55	"	"	"	.175	11 in.	100 ft.	
56	.088	2.06	7° twisted	.200	3 in.	100 yd.	short chamfer
57	"	"	"	"	17.5 in.	"	"
58	"	"	"	"	2 in.	"	"
59	"	"	"	"	1.5 in.	"	long chamfer
60	"	"	"	"	6 in.	"	"
61	"	"	"	"	2 in.	"	"
62	"	"	straight	"	29 in.	"	
63	"	"	"	"	19 in.	"	
64	"	"	"	"	2 in.	200 ft.	lost at 100 yd.
65	"	"	"	"	19 in.	100 yd.	
66	"	"	"	"	42 in.	"	
67	"	"	7° twisted	"	12 in.	"	long chamfer
68	"	"	"	"	18 in.	"	"
69	"	"	"	"	17.5 in.	"	"
70	"	"	"	"	6 in.	"	"
71	"	"	"	"	3 in.	"	short chamfer
72	"	"	"	"	21.5 in.	"	"
73	"	"	"	"	28 in.	"	"
74	"	"	"	"	5 in.	"	long chamfer
75	"	"	"	"	8.5 in.	"	"
76	"	"	"	"	8 in.	"	"
77	"	"	"	"	7 in.	"	"
78	"	"	"	"	4.5 in.	"	"
79	"	"	"	"	5.5 in.	"	"
80	"	"	"	"	2.5 in.	"	"
81	"	"	"	"	14.5 in.	"	"
82	"	"	"	"	7 in.	"	"
83	"	"	"	"	9 in.	"	"
84	"	"	"	"	37.5 in.	"	"
85	"	"	"	"	11.5 in.	"	"

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SINGLE PROJECTILES (con't.)

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Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
86	.088	2.06	7° twisted	.200	14 in.	100 yd.	long chamfer
87	"	"	"	"	5.5 in.	"	"
88	"	"	"	"	23 in.	"	"
89	"	"	"	"	8 in.	"	"
90	"	"	"	"	18 in.	"	"
91	"	"	"	"	9 in.	"	"
92	"	"	"	"	7 in.	"	"
93	"	"	"	"	5 in.	"	"
94	"	"	"	"	10.5 in.	"	"
95	"	"	"	"	8 in.	"	"
96	"	"	"	"	2.5 in.	"	"
97	"	"	"	"	14 in.	"	short chamfer
98	"	"	"	"	4 in.	"	"
99	"	"	"	"	13 in.	"	"
100	"	"	"	"	25 in.	200 ft.	lost at 100 yd.
101	"	"	"	"	5 in.	100 yd.	short chamfer
102	"	"	3° formed	"	13.5 in.	"	
103	"	"	"	"	9 in.	"	
104	"	"	"	"	18 in.	"	
105	"	"	"	"	20 in.	"	
106	"	"	"	"	7 in.	"	
107	"	"	"	"	3 in.	"	
108	"	"	"	"	13 in.	"	
109	"	"	"	"	7 in.	"	
110	"	"	"	"	7 in.	"	
111	"	"	"	"	15.5 in.	100 ft.	lost at 200 ft.
112	"	"	7° extra long	"	22.5 in.	200 ft.	lost at 100 yd.
113	"	"	"	"	6 in.	100 yd.	
114	"	"	"	"	22.5 in.	"	
115	"	"	"	"	16 in.	"	
116	"	"	3° formed	"	5 in.	200 ft.	lost at 100 yd.
117	"	"	"	"	5 in.	100 ft.	lost at 200 ft.
118	"	"	"	"	29 in.	100 yd.	
119	"	"	3° formed	"	3.5 in.	"	
120	"	"	"	"	4 in.	"	
121	"	"	"	"	5 in.	"	
122	"	"	"	"	13 in.	"	
123	"	"	"	"	9.5 in.	"	
124	"	"	"	"	10 in.	"	
125	"	"	"	"	7 in.	"	

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SINGLE PROJECTILES (con't.)

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Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
126	.083	7.06	30° formed	.200	8 in.	100 yd.	
127	"	"	"	"	10 in.	"	
128	"	"	"	"	18.5 in.	"	
129	"	"	"	"	14.5 in.	"	blunt nose
130	"	"	"	"	8.5 in.	"	"
131	"	"	"	"	6 in.	"	"
132	"	"	70° formed	"	24 in.	"	
133	"	"	"	"	10.5 in.	"	
134	"	"	"	"	11 in.	"	
135	"	"	"	"	7 in.	"	
136	"	"	"	"	7 in.	"	
137	"	"	"	"	3 in.	"	
138	"	"	"	"	20 in.	"	
139	"	"	"	"	10.5 in.	"	
140	"	"	"	"	5 in.	"	blunt nose
141	"	"	"	"	15.5 in.	"	"
142	"	"	"	"	13.5 in.	"	"
143	"	"	"	"	7.5 in.	"	"
144	"	"	"	"	8 in.	"	"
145	"	"	30° as formed	.200	1.5 in.	"	1060 stl. HT. 190,000 psi
146	"	"	"	"	1.5 in.	"	"
147	"	"	"	"	1 in.	"	"
148	"	"	"	"	5 in.	"	"
149	"	"	"	"	4.5 in.	"	"
150	"	"	"	"	8.5 in.	"	"
151	"	"	"	"	3 in.	"	"
152	"	"	"	"	4.5 in.	"	"
153	"	"	"	"	5 in.	"	"
154	"	"	"	"	13 in.	"	"
155	"	"	"	"	22.5 in.	"	"
156	"	"	30° as formed	.200	4.5 in.	285 ft.	"
157	"	"	"	"	4.5 in.	"	"
158	"	"	"	"	5.5 in.	"	"
159	"	"	"	"	14.5 in.	"	"
160	"	"	"	"	11 in.	"	"
161	"	"	"	"	4.6 in.	250 ft.	"
162	"	"	"	"	1.5 in.	"	"
163	"	"	"	"	6 in.	"	"
164	"	"	"	"	8 in.	"	"
165	"	"	"	"	16.5 in.	"	"

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SINGLE PROJECTILES (con't.)

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
166	.028	2.06	3° formed	.200	2 in.	200 ft.	1060 stl. HT. 190,000 psi
167	"	"	"	"	2 in.	"	"
168	"	"	"	"	5.5 in.	"	"
169	"	"	"	"	8.5 in.	"	"
170	"	"	"	"	11. in.	"	"
171	"	"	"	"	4.5 in.	150 ft.	"
172	"	"	"	"	3 in.	"	"
173	"	"	"	"	1.5 in.	"	"
174	"	"	"	"	1 in.	"	"
175	"	"	"	"	12.5 in.	"	"
176	"	"	"	"	2 in.	100 ft.	"
177	"	"	"	"	2 in.	"	"
178	"	"	"	"	4.5 in.	"	"
179	"	"	"	"	5.5 in.	"	"
180	"	"	"	"	3 in.	"	"
181	"	"	"	"	3 in.	50 ft.	"
182	"	"	"	"	3.5 in.	"	"
183	"	"	"	"	3.8 in.	"	"
184	"	"	"	"	5 in.	"	"
185	"	"	"	"	5.5 in.	"	"
186	"	"	"	.180	9 in.	285 ft.	"
187	"	"	"	"	9 in.	"	"
188	"	"	"	"	11 in.	"	"
189	"	"	"	"	8 in.	"	"
190	"	"	"	"	13.5 in.	"	"
191	"	"	"	"	3 in.	250 ft.	"
192	"	"	"	"	6 in.	"	"
193	"	"	"	"	4 in.	"	"
194	"	"	"	"	3 in.	"	"
195	"	"	"	"	7.5 in.	"	"
196	"	"	"	"	6 in.	200 ft.	"
197	"	"	"	"	11 in.	"	"
198	"	"	"	"	2.5 in.	"	"
199	"	"	"	"	4.5 in.	"	"
200	"	"	"	"	10 in.	"	"
201	"	"	"	"	9 in.	150 ft.	"
202	"	"	"	"	0.6 in.	"	"
203	"	"	"	"	4 in.	"	"
204	"	"	"	"	4 in.	"	"
205	"	"	"	"	6 in.	"	"

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SINGLE PROJECTILES (con't.)

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
206	.088	2.06	3° formed	.180	3.5 in.	100 ft.	1060 stl. HT. 190,000 psi
207	"	"	"	"	2.5 in.	"	"
208	"	"	"	"	3.5 in.	"	"
209	"	"	"	"	6.7 in.	"	"
210	"	"	"	"	8 in.	"	"
211	"	1.50	"	.175	7 in.	100 yd.	"
212	"	"	"	"	5 in.	"	"
213	"	"	"	"	7 in.	"	"
214	"	"	"	"	7 in.	"	"
215	"	"	"	"	5.5 in.	"	"
216	"	"	"	"	9 in.	"	"
217	"	"	"	"	4.5 in.	"	"
218	"	"	"	"	6.5 in.	"	"
219	"	"	"	"	8 in.	"	"
220	"	"	"	"	17 in.	"	"
#221 to #230 - NO RECORD							
231	.088	1.50	2° formed	.175	4.5 in.	100 yd.	1060 stl. HT. 190,000 psi
232	"	"	"	"	1.5 in.	"	"
233	"	"	"	"	3.5 in.	"	"
234	"	"	"	"	11 in.	"	"
235	"	"	"	"	7 in.	"	"
236	"	"	"	"	8 in.	"	"
237	"	"	"	"	3 in.	"	"
238	"	"	"	"	6 in.	"	"
239	"	"	"	"	4 in.	"	"
240	"	"	"	"	5.5 in.	"	"
241	"	"	"	"	21 in.	"	"
242	"	"	"	"	11 in.	"	"
243	"	"	"	"	5.5 in.	"	"
244	"	"	"	"	6 in.	"	"
245	"	"	"	"	5 in.	"	"
246	"	"	"	"	7 in.	"	"
247	"	"	"	"	1 in.	"	"
248	"	"	"	"	1 in.	"	"
249	"	"	"	"	1.5 in.	"	"
250	"	"	"	"	2 in.	"	"
251	"	"	1° formed	"	3 in.	"	"
252	"	"	"	"	1 in.	"	"
253	"	"	"	"	1.5 in.	"	"
254	"	"	"	"	1.3 in.	"	"
255	"	"	"	"	2 in.	"	"

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SINGLE PROJECTILES (con't.)

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Round Number	Diameter	Projectile Length.	Type of Fin	Fin Span	Distance Off Bore sight	Range	Remarks
256	.088	1.00	1° formed	.175	3 in.	100 yd.	1060 stl. HT. 190,000 psi
257	"	"	"	"	1 in.	"	"
258	"	"	"	"	9 in.	"	"
259	"	"	"	"	1 in.	"	"
260	"	"	"	"	No Record	"	"
#261 to #270 - NO RECORD							
271	.088	2.00	3° formed	.200	6.5 in.	100 yd.	1060 stl. HT. 190,000 psi
272	"	"	"	"	2 in.	"	"
273	"	"	"	"	12 in.	"	"
274	"	"	"	"	16.5 in.	"	"
275	"	"	"	"	3 in.	"	"
276	"	"	"	"	3 in.	"	"
277	"	"	"	"	5.5 in.	"	"
278	"	"	"	"	28 in.	"	"
279	"	"	"	"	8 in.	"	"
280	"	"	"	"	3.5 in.	"	"
281	"	"	2° formed	"	3 in.	"	"
282	"	"	"	"	8 in.	"	"
283	"	"	"	"	7 in.	"	"
284	"	"	"	"	2 in.	"	"
285	"	"	"	"	2 in.	"	"
286	"	"	"	"	2 in.	"	"
287	"	"	"	"	4 in.	"	"
288	"	"	"	"	3.5 in.	"	"
289	"	"	"	"	8.5 in.	"	"
290	"	"	"	"	3 in.	"	"
#291 to #320 - NO RECORD							
321	.088	2.00	1° formed	.200	8 in.	100 yd.	1060 stl. HT. 190,000 psi
322	"	"	"	"	No Record	"	"
323	"	"	"	"	8 in.	"	"
324	"	"	"	"	No Record	"	"
325	"	"	"	"	6 in.	"	"
326	"	"	"	"	3.5 in.	"	"
327	"	"	"	"	9 in.	"	"
328	"	"	"	"	2 in.	"	"
329	"	"	"	"	5.5 in.	"	"
330	"	"	"	"	3 in.	"	"
331	"	"	"	"	No Record	"	"
332	"	"	"	"	3.5 in.	"	"
333	"	"	"	"	5.5 in.	"	"
334	"	"	"	"	8 in.	"	"
335	"	"	"	"	8 in.	"	"

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SINGLE PROJECTILE (con't.)

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Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
336	.088	2.06	1° formed	.200	3.5 in.	100 yd.	1060 stl. HT. 190,000 psi
337	"	"	"	"	10.5 in.	"	"
338	"	"	"	"	11.5 in.	"	"
339	"	"	"	"	No Record	"	"
340	"	"	"	"	No Record	"	"
341	"	"	2° canted Delta	.195	2 in.	"	"
342	"	"	"	"	2.5 in.	"	"
343	"	"	"	"	4 in.	"	"
344	"	"	"	"	1.5 in.	"	"
345	"	"	"	"	4.5 in.	"	"
346	"	"	"	"	0.2 in.	"	"
347	"	"	"	"	1 in.	"	"
348	"	"	"	"	4.5 in.	"	"
349	"	1.50	2° formed	.160	6.5 in.	"	"
350	"	"	"	"	4 in.	"	"
351	"	"	"	"	5 in.	"	"
352	"	"	"	"	3.5 in.	"	"
353	"	"	"	"	3 in.	"	"
354	"	"	"	"	2.5 in.	"	"
355	"	"	"	"	9 in.	"	"
356	"	"	"	"	9.5 in.	"	"
357	"	"	"	.150	4 in.	"	"
358	"	"	"	"	11.5 in.	"	"
359	"	"	"	"	3.5 in.	"	"
360	"	"	"	"	5.5 in.	"	"
361	"	"	"	"	11 in.	"	"
362	"	"	"	"	4 in.	"	"
363	"	"	"	"	1 in.	"	"
364	"	"	"	"	8 in.	"	"
365	"	"	"	"	7.5 in.	"	"
366	"	"	"	.140	7 in.	"	"
367	"	"	"	"	6 in.	"	"
368	"	"	"	"	4 in.	"	"
369	"	"	"	"	6 in.	"	"
370	"	"	"	"	2.5 in.	"	"
371	"	"	"	"	1 in.	"	"
372	"	"	"	"	6 in.	"	"
373	"	"	"	"	14.5 in.	"	"
374	"	"	"	"	12 in.	"	"

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ER-137G  
p.8

\* 20 MM. ROUNDS

Number	Type of Projectile	Cant Angle	Length Span	Hits in Diameter				Type of Round	Fer-Hits	Per-cent	Report Page No.
				2 ft	4 ft	6 ft	8 ft				
1	1595	None	-	2.06L	4	4	50	12 ft	"	"	ER-137 p.31
2	941	36	-	.175S	"	2	75	12 ft	"	"	
3	1390	32	-	"	"	1	75	12 ft	"	"	
4	1755	16	-	2.06L	0	75	75	12 ft	"	"	
5	860	32	-	.165S	2.06L	1	100	12 ft	"	"	
6	1180	16	-	.175S	2.06L	2	100	12 ft	"	"	
7	865	32	-	.175S	2.06L	0	100	12 ft	"	"	
8	890	16	-	.165S	1.50L	0	100	12 ft	"	"	
9	1174	16	-	.180S	.180S	1	100	12 ft	"	"	
10	1025	16	-	.180S	1.50L	16	16	12 ft	"	"	
11	789	16	-	.180S	2.06L	15	15	12 ft	"	"	
12	12	21	70	.180	.180	15	15	12 ft	"	"	ER-137D p.50
13	21	21	70	.180	.180	6	6	12 ft	"	"	
14	21	21	70	.180	.180	3	3	12 ft	"	"	
15	21	21	70	.180	.180	3	3	12 ft	"	"	
16	21	21	70	.180	.180	8	8	12 ft	"	"	
17	21	21	70	.180	.180	10	10	12 ft	"	"	
18	21	21	70	.180	.180	6	6	12 ft	"	"	
19	21	21	70	.180	.180	12	5	12 ft	"	"	
20	21	21	70	.180	.180	5	5	12 ft	"	"	
21	21	21	70	.180	.180	4	4	12 ft	"	"	
22	21	21	70	.180	.180	5	5	12 ft	"	"	
23	21	21	70	.180	.180	18	18	12 ft	"	"	
24	21	21	30	.180	0	1	1	12 ft	"	"	

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20 MM ROUNDS												CONFIDENTIAL											
Number	Type of Projectile	Cant.	Length <sup>2</sup>	Span	Hits in Diameter						Type of	Rang	Cent	12 ft	ft	Diam.	Report	Page	No.				
					2 ft	4 ft	6 ft	8 ft	10 ft	12 ft				Round	Yards	Hits	Report	Page					
25	2°	"	.180	0	0	2	2	1	1	1	A	"	"	24	ER-137G p.6	"	P.4						
26	"	"	"	0	1	2	3	3	4	11	A	"	"	62	ER-137G p.20	"	P.21						
27	"	"	"	2	3	7	7	9	13	15	A	"	"	19	"	"	"	P.22					
28	"	"	"	"	5	7	12	13	15	18	A	"	"	62	"	"	"	P.23					
29	"	"	"	"	10	15	17	19	20	20	A	"	"	90	67	"	"	P.24					
30	"	"	"	"	5	7	12	14	19	19	A	"	"	90	81	81	81	ER-137G p.6					
31	"	"	"	"	15	17	17	17	17	17	B	"	"	76	"	"	"	P.25					
32	"	"	"	"	15	17	17	17	17	17	B	"	"	67	"	"	"	P.26					
33	"	"	"	"	11	14	16	17	17	17	C	"	"	52	"	"	"	P.27					
34	"	"	"	"	5	11	13	13	13	13	C	"	"	57	"	"	"	"					
35	"	"	"	"	5	11	14	13	18	21	C	"	"	31	67	"	"	"					
36	"	"	"	"	5	11	14	13	18	21	C	"	"	67	"	"	"	"					
37	"	"	"	"	5	11	14	12	15	18	C	"	"	36	71	"	"	"					
38	"	"	"	"	5	11	13	16	18	19	D	"	"	90	86	"	"	"					
39	"	"	"	"	6	11	13	15	17	17	E	"	"	81	81	81	81	"					
40	"	"	"	"	4	9	11	15	17	17	F	"	"	67	"	"	"	"					
41	"	"	"	"	5	9	14	14	14	17	G	"	"	38	"	"	"	"					
42	"	"	"	"	3	6	9	12	17	18	H	"	"	86	"	"	"	"					
43	"	"	"	"	7	12	13	15	17	18	I	"	"	81	"	"	"	"					
44	"	"	"	"	1	4	6	9	13	19	J	"	"	43	"	"	"	"					
45	"	"	"	"	1	3	5	7	9	10	K	"	"	48	"	"	"	"					
46	"	"	"	"	1	3	5	7	9	10	L	"	"	62	"	"	"	"					
47	"	"	"	"	1	3	5	7	9	10	M	"	"	57	"	"	"	"					
48	"	"	"	"	1	4	6	8	10	12	N	"	"	52	"	"	"	"					
49	"	"	"	"	1	4	6	9	11	14	O	"	"	57	"	"	"	"					
50	"	"	"	"	0	2	4	6	8	11	P	"	"	52	"	"	"	"					
51	"	"	"	"	0	2	4	6	8	11	Q	"	"	57	"	"	"	"					
52	"	"	"	"	1	3	5	7	9	11	R	"	"	67	"	"	"	"					
53	"	"	"	"	1	4	6	8	10	13	S	"	"	86	"	"	"	"					
54	"	"	"	"	42	2°	1	4	5	7	T	"	"	71	"	"	"	"					
55	"	"	"	"	"	"	"	"	"	"	U	"	"	18	"	"	"	"					
56	"	"	"	"	"	"	"	"	"	"	V	"	"	12	"	"	"	"					
57	"	"	"	"	"	"	"	"	"	"	W	"	"	9	"	"	"	"					
58	"	"	"	"	"	"	"	"	"	"	X	"	"	10	"	"	"	"					

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ARMAMENTS  
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Number	Type of Projectile Giant	Length & Span	Hits in Diameter										Type of Round	Range Yards	Per- cent Hits	Report No.
			2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Total	Round	Hits	Diam.				
56	20	.206L .200S	0	1	1	5	8	11	XI	100	52	38	Aug. '53 p.6	"	"	"
60	"	"	1	3	8	10	13	14	XI	"	67	67	"	"	"	"
61	"	"	2	7	9	14	18	20	XI	"	100	95	"	"	"	"
62	"	"	0	6	9	10	13	14	XI	"	71	67	"	"	"	"
63	"	"	3	5	9	11	12	15	XI	"	86	81	"	"	"	"
64	"	"	5	8	11	14	15	17	XII	"	90	81	"	"	"	"
65	"	"	2	4	7	12	14	17	XII	"	90	81	"	"	"	"
66	"	"	0	6	8	14	17	17	XII	"	76	67	"	"	"	"
67	"	"	2	5	7	9	11	14	XII	"	90	76	"	"	"	"
68	"	"	10	12	14	16	19	19	XII	"	86	36	"	"	"	"
69	"	"	13	17	18	18	18	18	IV	"	43	29	"	"	"	"
70	"	"	1	3	5	6	7	9	IV	"	52	33	"	"	"	"
71	"	"	0	2	5	6	7	8	IV	"	71	71	"	"	"	"
72	"	"	0	1	2	1	2	1	IV	"	76	76	"	"	"	"
73	"	"	1	1	0	0	0	0	IV	"	90	57	Sept. '53 p.12	"	"	"
74	"	"	0	0	0	0	0	0	X	"	"	"	"	"	"	"
75	"	"	12	12	15	16	15	16	X	"	71	76	"	"	"	"
76	"	"	6	10	15	14	16	16	X	"	95	76	"	"	"	"
77	"	"	11	12	13	11	13	15	X	"	100	71	"	"	"	"
78	"	"	7	7	7	7	7	7	X	"	95	71	"	"	"	"
79	"	"	5	5	5	5	5	5	X	"	100	71	"	"	"	"
80	"	"	0	0	0	0	0	0	X	"	9	9	"	"	"	"
81	"	"	0	0	0	0	0	0	X	"	100	71	"	"	"	"
82	"	"	3	3	3	3	3	3	X	"	43	43	Oct. '53 p.6	"	"	"
83	"	"	2	2	2	2	2	2	X	"	86	14	"	"	"	"
84	"	"	2	2	2	2	2	2	X	"	33	24	"	"	"	"
85	"	"	0	0	0	0	0	0	X	"	67	52	"	"	"	"
86	"	"	0	0	0	0	0	0	X	"	95	86	"	"	"	"
87	"	"	0	0	0	0	0	0	X	"	100	100	"	"	"	"
88	"	"	0	0	0	0	0	0	X	"	14	24	"	"	"	"
89	"	"	0	0	0	0	0	0	X	"	10	14	"	"	"	"
90	"	"	0	0	0	0	0	0	X	"	17	18	"	"	"	"

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Number	Type of Projectile	Length & Cnt	Span	Hits in Diameter						Type of Range	Per-Hits cent	Report Page No.	
				2 ft	4 ft	6 ft	8 ft	10 ft	12 ft				
91	21	2 <sup>0</sup>	2.06	3	6	9	11	12	17	21	XVIII	100	100
92	21	2 <sup>0</sup>	.20	1	1	1	3	6	7	21	XVII	100	100
93	1999	21	2 <sup>0</sup>	1	2	6	15	19	21	27	XV	100	84
94	1994	32	"	4	5	6	9	13	13	25	XV	100	75
95	1994	32	"	2	8	12	16	19	21	28	XV	100	88
96	1971	32	"	1	1	4	6	10	10	25	XV	100	78
97	2012	32	"	0	2	10	14	17	18	27	XV	100	84
98	1392	32	"	1	1	3	7	8	14	18	XVII	100	86
99	1909	31	"	2	4	10	15	17	18	30	XVII	100	95
100	1921	41	"	0	1	4	7	9	13	19	XVII	100	62
101	1933	41	"	1	2	3	5	5	11	16	XVII	100	52
102	1974	52	"	0	0	1	2	3	5	14	XVI	100	44
											mod.		

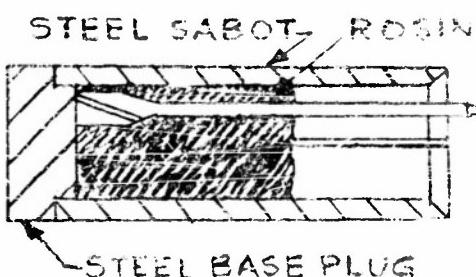
\* Alternate projectiles with fins. .25 inch from Rear End.

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20 FT. ROUNDS

ROUND TYPE-A



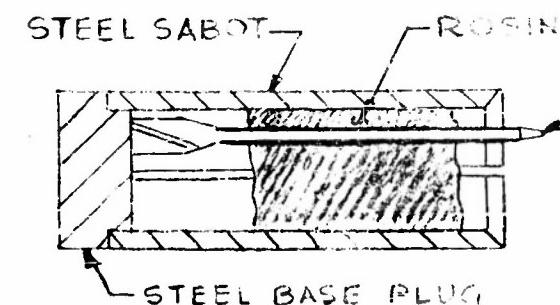
-21 PROJECTILES  
.190 SPAN  
3° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	58			
BEST ROUND	50			

TOTAL ROUNDS FIRED-6

ROUND TYPE-B



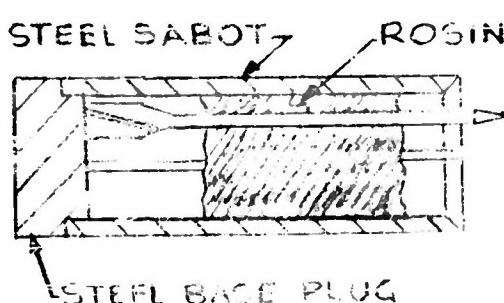
-21 PROJECTILES  
.199 TO .195 SPAN  
3° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	6.3			
BEST ROUND	8			

TOTAL ROUNDS FIRED-3

ROUND TYPE-C



-21 PROJECTILES  
.199 TO .195 SP...  
3° FIN CANT  
SLIGHTLY ECCENTRIC FIN

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	7.2			
BEST ROUND	11			

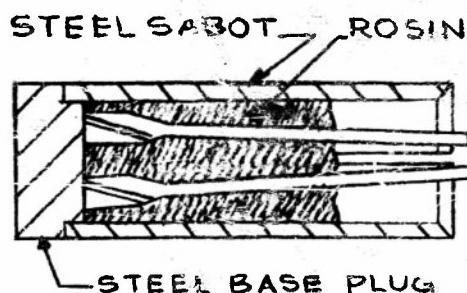
TOTAL ROUNDS FIRED-4

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20MM ROUNDS

ROUND TYPE - D



TOTAL ROUNDS FIRED - 1

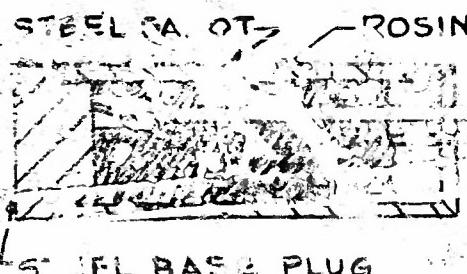
21 PROJECTILES  
.197 SPAN  
3° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	[REDACTED]	11		
BEST ROUND	[REDACTED]	"		

ROUND TYPE - E



TOTAL POUNDS FIRED - 3

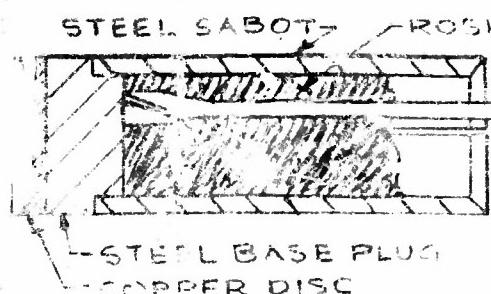
21 PROJECTILES  
.197

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	10	5		
BEST ROUND	10	9		

ROUND TYPE - FCG



TOTAL ROUNDS FIRED - 7

21 PROJECTILES  
.197 SPAN  
3° FIN CANT  
IRON PLATED

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	10	76		
BEST ROUND	10	76		

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### ROUND TYPE - H

STEEL SABOT ROSIN



STEEL BASE PLUG  
COPPER DISC

TOTAL ROUNDS FIRED - 4

NO. OF PROJECTILES  
.200 SPAN  
2° FIN CANE

NO. OF PROJECTILES  
.200 SPAN AT 100 YDS.

AVERAGE  
ROUND

2 5 0 5

### ROUND TYPE - I

STEEL SABOT - STEEL PLUG



STEEL BASE PLUG  
COPPER DISC

TOTAL ROUNDS FIRED - 5

NO. OF PROJECTILES

.175 SPAN

2° FIN CANE

1 7 5 0 5

NO. OF PROJECTILES

.175 SPAN

2° FIN CANE

AVERAGE  
ROUND

5

BEST  
ROUND

5

### ROUND TYPE - J1

STEEL SABOT

ROSIN



STEEL BASE PLUG

ALUMINUM BRASS PLUG

TOTAL ROUNDS FIRED - 5

NO. OF PROJECTILES  
.200 SPAN  
2° FIN CANE

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS

0 5 0

AVERAGE  
ROUND

5

BEST  
ROUND

5

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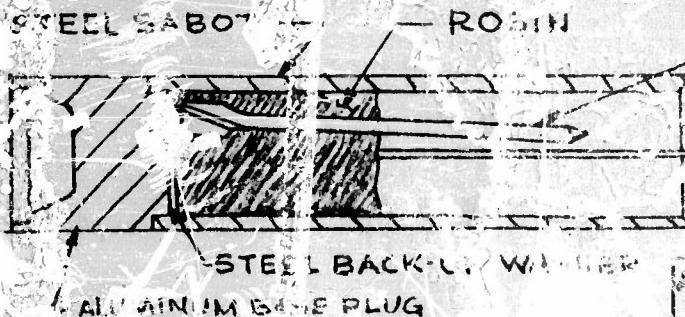
*John*  
**JOHNSON & SONS  
INC.**

505

SP-1 EIGHT

100 POUNDS

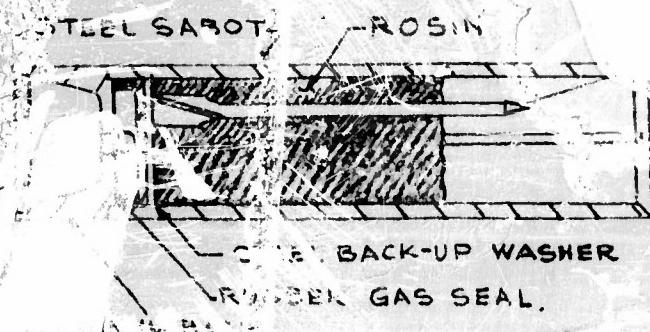
ROUND TYPE - II



TOTAL ROUNDS FIRED - 5

NO. OF PDS		IN GFT. DIA.		ES YDS.	
15	20	0	1	15	20
RAGE	POUNDS				
BEST	ROUND				

ROUND TYPE - IV



TOTAL ROUNDS FIRED

NO. IN G		200 FT.		100 FT.	
0	1	2	3	4	5
AVERAGE	ROUND				
BEST	ROUND				

NO TYPE



TOTAL ROUNDS FIRED - 5

NO. IN G		200 FT.		100 FT.	
0	1	2	3	4	5
AVERAGE	ROUND				
BEST	ROUND				

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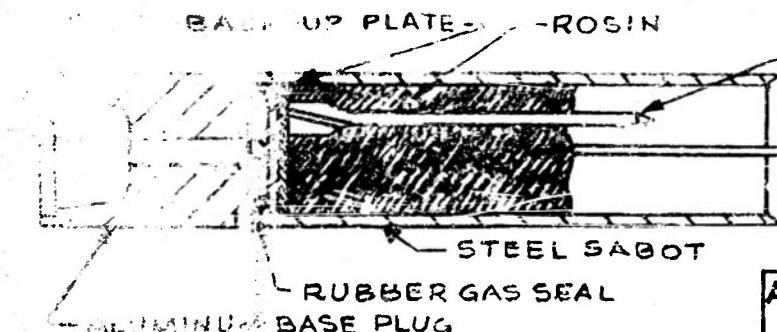
*DATA TEST*  
*COMPONENTS*  
INC.

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ROUND ROUNDS

ROUND TYPE-III



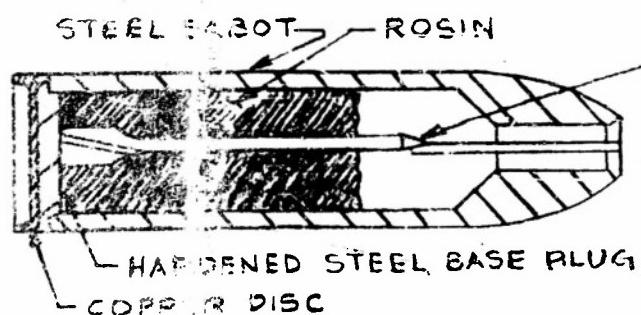
TOTAL ROUNDS FIRED-5

21 PROJECTILES  
.200 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	6			
BEST ROUND	11			

ROUND TYPE-VII



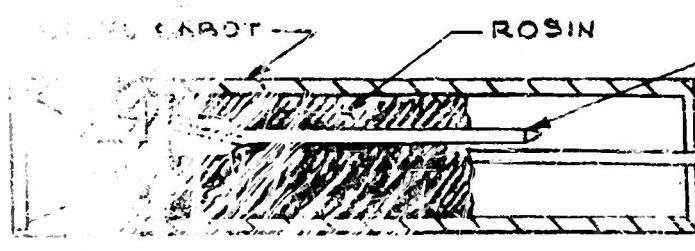
TOTAL ROUNDS FIRED-4

21 PROJECTILES  
.200 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	25			
BEST ROUND	4			

ROUND TYPE-XVIII



BASE PLUG ASSEMBLY

TOTAL ROUNDS FIRED-5

21 PROJECTILES  
.200 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	5.1			
BEST ROUND	9			

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**AIRCRAFT  
ARMAMENTS  
INC.**

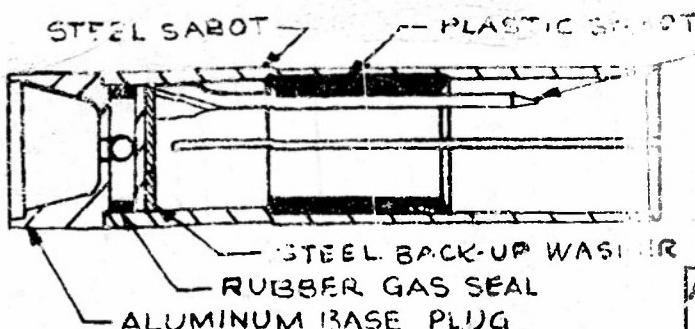
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20MM ROUNDS

**ROUND TYPE-XV**

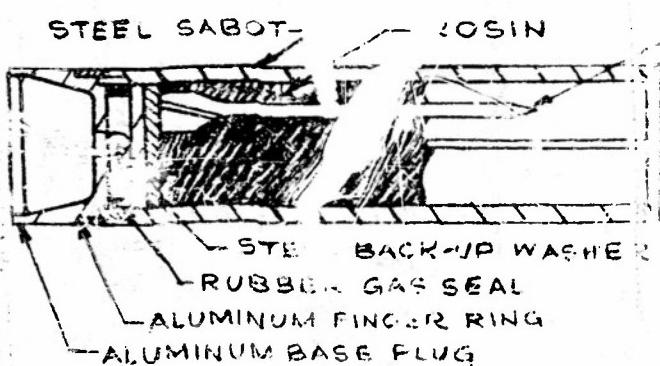


TOTAL ROUNDS FIRED - 5

32 PROJECTILES  
2.00 SPAN  
2 FIN CANT

NO. OF PROJECTILES	DIA. AT 100 YDS.	ES YDS.
5	5	20
8		
12		

**ROUND TYPE-X**



TOTAL ROUNDS FIRED - 4

PROJECTILES  
AT 100 YDS.  
10 15 20

5		
10		

**ROUND TYPE-**

TOTAL ROUNDS FIRED -

NO. OF PROJECTILES  
IN 6 FT DIA. AT 100 YDS.  
10 15 20

AVERAGE ROUND	10	15	20
BEST ROUND			

Number	Target Object	Range	Length	Angle	Hits in Diameter	Per-hits cent	Report	Range cent	12 ft Page	ERL37F P.5 or ER228	ERL37C P.26 ER228 P.17	ERL37H P.5	ERL37G P.5	ERL37H P.5	ERL37G P.5
30	Welded plates	3 ft	4 ft	120°	6	6	ERL37F	100	"	"	"	"	"	"	"
31	Four Grants jumbo boards	2 ft	4 ft	120°	9	9	"	"	"	"	"	"	"	"	"
32	Four Grants jumbo boards	3 ft	10 ft	120°	12	12	"	"	"	"	"	"	"	"	"
33	Four Grants jumbo boards	4 ft	12 ft	120°	15	15	"	"	"	"	"	"	"	"	"
34	Four Grants jumbo boards	5 ft	15 ft	120°	18	18	"	"	"	"	"	"	"	"	"
35	Four Grants jumbo boards	6 ft	18 ft	120°	21	21	"	"	"	"	"	"	"	"	"
36	Four Grants jumbo boards	7 ft	21 ft	120°	24	24	"	"	"	"	"	"	"	"	"
37	Four Grants jumbo boards	8 ft	24 ft	120°	27	27	"	"	"	"	"	"	"	"	"
38	Four Grants jumbo boards	9 ft	27 ft	120°	30	30	"	"	"	"	"	"	"	"	"
39	Four Grants jumbo boards	10 ft	30 ft	120°	33	33	"	"	"	"	"	"	"	"	"
40	Four Grants jumbo boards	11 ft	33 ft	120°	36	36	"	"	"	"	"	"	"	"	"
41	Four Grants jumbo boards	12 ft	36 ft	120°	39	39	"	"	"	"	"	"	"	"	"
42	Four Grants jumbo boards	13 ft	39 ft	120°	42	42	"	"	"	"	"	"	"	"	"
43	Four Grants jumbo boards	14 ft	42 ft	120°	45	45	"	"	"	"	"	"	"	"	"

see ERL37F, pg. 9, Type IIA  
see ERL37F, pg. 9, Type I

see ERL37F, pg. 9, Type IIB  
see ERL37F, pg. 9, Type I

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Number	Type of Projectile	Cant Length in ft	Angle	Hits in Diameter	Hits in Diam.	Type	Range of	Per cent	Report			
										ER238 or ER137H p.5		
Round	Weight Grains in Round	Length in ft	Angle	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Hits	Page No.	
Number	Weight Grains in Round	Length in ft	Angle	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Hits	Report No.	
46	580	21	30	.175	0	1	6	9	12	13	15	ER228
47	"	"	"	"	2	7	14	21	21	"	"	"
48	"	"	"	"	1	2	10	13	13	13	13	"
49	"	"	"	"	0	2	3	4	7	7	7	"
50	"	"	"	"	1	2	4	4	9	11	11	"
51	"	"	"	"	2	4	10	13	17	17	17	"
52	"	"	"	"	3	7	10	14	18	20	20	"
53	"	"	"	"	0	4	7	10	13	13	13	"
54	"	"	"	"	1	2	5	8	10	13	13	"
55	"	"	"	"	0	0	5	8	11	13	13	"
56	"	"	"	"	2	3	8	11	13	15	15	"
57	"	"	"	"	1	4	10	12	14	15	16	"
58	"	"	"	"	1	1	3	6	10	14	16	"
59	"	"	"	"	0	1	7	12	19	21	21	"
60	"	"	"	"	0	1	8	14	15	18	18	"
61	"	"	"	"	1	4	13	15	18	19	19	"
62	"	"	"	"	1	1	4	4	7	9	11	"
63	"	"	"	"	0	1	2	1	2	5	5	"
64	"	"	"	"	1	2	3	4	4	5	5	"
65	"	"	"	"	0	1	2	2	2	3	3	"
66	"	"	"	"	1	2	2	5	8	12	12	"
67	"	"	"	"	1	2	3	4	5	9	11	"
68	"	"	"	"	0	1	2	2	3	17	17	"
69	"	"	"	"	1	2	2	3	4	18	18	"
70	"	"	"	"	1	2	2	3	4	15	15	"
71	"	"	"	"	0	0	0	0	0	10	10	"
72	"	"	"	"	1	0	0	0	0	12	12	"
73	"	"	"	"	0	0	0	0	0	15	15	"
74	"	"	"	"	1	0	0	0	0	14	14	"
75	"	"	"	"	0	0	0	0	0	12	12	"
76	"	"	"	"	1	0	0	0	0	17	17	"
77	"	"	"	"	0	0	0	0	0	17	17	"
78	"	"	"	"	1	0	0	0	0	18	18	"
79	"	"	"	"	0	0	0	0	0	19	19	"
80	"	"	"	"	1	0	0	0	0	18	18	"
81	"	"	"	"	0	0	0	0	0	17	17	"
82	"	"	"	"	1	0	0	0	0	18	18	"

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12 GAGE SHOTGUN

Number Round Number	Weight Grains in Bore	Type of Projectile Cant. Angle	Length Span	Hits in Diameter								Type of Range	Per- cent Hits	Report No.
				2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Total	Round			
52	530	21	.30	.175	1	9	13	16	19	20	ER228	100	ER228 or ER137H p.5	"
84	"	"	"	"	3	6	10	11	14	20	"	"	ER137J p.21	"
85	"	"	"	"	5	7	11	12	13	15	"	"	P.22	"
86	"	"	"	.20	0	1	3	4	6	7	"	"	ER137 Aug. p.23	"
87	"	"	"	"	20	.150	2	2	5	9	11	13	"	"
88	89	"	"	"	"	"	3	8	12	13	15	20	"	50
90	91	"	"	"	"	"	2	11	14	16	18	19	"	50
92	92	"	"	"	"	"	0	3	4	7	7	10	"	48
93	"	"	"	"	"	"	0	2	7	7	12	15	"	50
94	94	"	"	"	"	"	"	1	4	4	7	8	"	47
95	95	"	"	"	"	"	1	3	5	6	11	13	"	47
96	96	"	"	"	"	"	0	2	4	6	9	9	"	47
97	97	"	"	"	"	"	1	1	3	6	9	12	"	47
98	98	"	"	"	"	"	2	1	3	6	11	13	"	47
99	99	"	"	"	"	"	2	2	5	7	11	13	"	47
100	100	"	"	"	"	"	1	1	3	5	8	10	"	47
101	101	"	"	"	"	"	1	2	2	5	6	14	"	47
102	102	"	"	"	"	"	1	2	2	7	11	16	"	47
103	103	"	"	"	"	"	0	4	8	10	12	15	"	47
104	104	"	"	"	"	"	0	0	2	2	6	8	"	47
105	105	"	"	"	"	"	0	0	2	2	7	10	"	47
106	106	"	"	"	"	"	0	0	2	2	7	10	"	47
107	107	"	"	"	"	"	0	0	2	2	7	10	"	47
108	108	"	"	"	"	"	0	0	2	2	7	10	"	47
109	109	"	"	"	"	"	0	0	2	2	7	10	"	47
110	110	"	"	"	"	"	0	0	2	2	7	10	"	47
111	111	"	"	"	"	"	0	0	2	2	7	10	"	47
112	112	"	"	"	"	"	0	0	2	2	7	10	"	47
113	113	"	"	"	"	"	0	0	2	2	7	10	"	47

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12 GAGE SHOTGUN

Number	Weight of Projectile	Type of Projectile	Cant Angle	Length & Span	Hits in Diameter						Type of Range	Per cent Hits	Report No.		
					2 ft	4 ft	6 ft	8 ft	10 ft	12 ft					
114	21	20	"	.160	4	4	10	14	17	19	G	100	90	ERU37 Sept. P. 11	
115	"	"	"	"	5	2	9	13	14	16	G	"	76	76	"
116	"	"	"	"	5	5	10	13	18	16	G	"	76	77	"
117	"	"	"	"	2	2	4	4	9	11	D	"	90	86	"
118	32	"	"	"	2	6	10	14	15	12	C	"	37	34	"
119	"	"	"	"	5	5	10	14	15	18	"	"	56	47	"
120	"	"	"	"	0	0	3	7	11	17	"	"	52	34	"
121	"	"	"	"	0	2	13	19	24	26	D	"	67	51	"
122	"	"	"	"	0	0	23	25	27	31	"	"	97	84	"
123	"	"	"	"	0	0	10	10	19	21	B	"	59	31	"
124	"	"	"	"	0	0	11	13	15	18	"	"	66	47	"
125	"	"	"	"	0	0	10	10	13	18	"	"	56	42	"
126	"	"	"	"	0	0	11	13	13	13	F	"	41	42	"
127	"	"	"	"	0	0	6	9	11	11	G	"	44	24	"
128	"	"	"	"	0	0	6	6	12	12	H	"	56	50	"
129	"	"	"	"	0	0	10	14	14	16	"	"	100	100	"
130	23	"	"	"	0	0	11	17	21	22	G	"	30	86	ERU37 Oct. P. 7
131	21	"	"	"	0	0	11	11	15	18	H	"	100	67	"
132	"	"	"	"	0	0	10	14	16	18	"	"	76	57	"
133	"	"	"	"	0	0	4	6	12	14	"	"	52	39	"
134	"	"	"	"	0	0	3	4	5	6	"	"	67	57	"
135	"	"	"	"	0	0	9	19	28	28	J	"	43	29	"
136	32	"	"	"	0	0	4	5	31	32	"	"	50	47	"
137	"	"	"	"	0	0	8	18	19	19	D	"	59	59	"
138	"	"	"	"	0	0	8	13	21	21	"	"	66	66	"
139	"	"	"	"	0	0	8	11	11	14	"	"	100	72	"
140	"	"	"	"	0	0	1	3	5	7	E	"	56	28	"
141	"	"	"	"	0	0	1	1	3	9	"	"	62	34	"
142	"	"	"	"	0	0	1	1	3	9	"	"	81	41	"
143	"	"	"	"	0	0	1	1	3	10	"	"	78	47	"
144	"	"	"	"	0	0	1	1	3	15	"	"	62	31	"
145	"	"	"	"	0	0	1	1	3	10	"	"	25	20	"

\*\* 3d. packed by Mr. Bird, O. C. O.

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P.2

## 12 GAGE SHOTGUN

Number of Pro- jectiles	Type of Projectile	Cant	Length Span	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Hits in Diameter	Type	Per- cent	Per- cent	Report	
											Total	Round	Yards	Diam.	No.
146	32	2°	.160	1	1	2	2	7	8	12	E	100	50	38	ER137 Oct. P.9
147	"	"	"	1	2	3	8	9	10	17	E	n	53	31	"
148	"	"	"	0	2	2	3	4	13	26	E	n	41	12.5	"
149	"	"	"	0	3	5	9	10	11	21	K	n	81	41	"
150	"	"	"	1	2	4	5	7	9	19	K	n	69	34	"
151	"	"	"	0	3	6	8	9	12	17	L	n	66	28	"
152	"	"	"	0	0	4	10	11	12	21	L	n	59	27	"
153	559	"	"	0	0	2	4	7	8	17	L	n	53	37	p.10A
154	654	"	"	0	0	0	10	12	18	21	L	n	66	25	"
155	659	"	"	0	0	0	10	12	18	21	L	n	81	66	"
156	659	"	"	0	0	1	4	6	7	10	L	n	50	31	"
157	"	"	"	0	0	1	3	6	6	11	L	n	72	34	"
158	"	"	"	0	0	2	5	5	12	19	L	n	94	59	"
159	636	"	"	0	0	1	2	3	7	10	L	n	50	31	"
160	636	"	"	0	0	1	2	3	7	10	C	n	59	28	"
161	636	"	"	0	0	1	2	2	5	7	C	n	50	31	"
162	639	"	"	0	0	2	4	8	11	17	B	n	69	47	"
163	639	"	"	0	0	0	0	10	11	22	B	n	53	34	"
164	639	"	"	0	0	2	0	2	4	17	M	n	69	34	"
165	665	"	"	0	0	1	5	7	13	20	M	n	94	63	"
166	663	"	"	0	0	0	3	5	7	11	N	n	66	50	"
167	660	"	"	0	0	4	4	12	24	26	N	n	75	34	"
168	675	"	"	0	0	3	8	13	14	21	N	n	81	50	"
169	676	"	"	0	0	1	3	6	7	11	N	n	84	66	"
170	678	"	"	0	0	2	5	6	9	13	P	n	81	34	"
171	628	"	"	0	0	0	2	6	7	13	F	n	78	41	"
172	630	"	"	"	"	"	"	"	"	"	P	n	91	59	"
173	629	"	"	"	"	"	"	"	"	"	F	n	91	41	"
174	699	"	"	"	"	"	"	"	"	"	D	n	58	47	"
175	695	"	"	"	"	"	"	"	"	"	D	n	56	19	"
176	690	"	"	"	"	"	"	"	"	"	D	n	88	19	"
177	570	28	"	"	"	"	"	"	"	"	P	n	86	54	"
178	571	28	"	"	"	"	"	"	"	"	P	n	82	23	"

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12 GAGE SHOTGUN

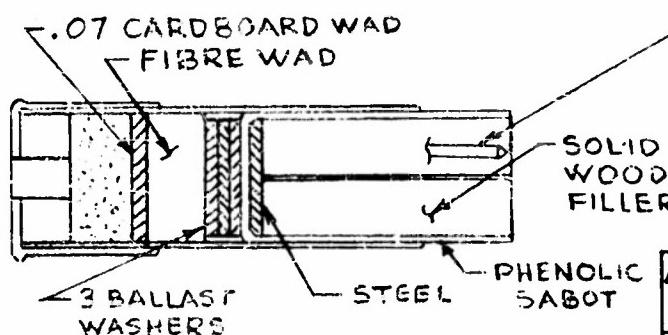
Number of Projectiles	Type of Projectile	Cant	Length & Spur.	Hits In Diameter	Type of Range	Per cent	Fir-	Report
Round	Weight Grains in Rounds	Angle	2 ft 4 ft 6 ft 8 ft 10 ft 12 ft	Total	12 ft	100	Hits	Hits
Number	Grains				Yards		Diam.	No.
179	630	32	.160	1 3 4 9	13	17	21	F 100
180	"	"	"	0 5 6	20	23	31	" "
181	"	"	"	3 7 11	16	24	31	" "
182	"	"	"	3 6 10	11	13	16	" "
183	"	"	"	1 4 11	15	21	23	" "
184	"	"	"	0 2 7	10	13	15	" "
185	570	28	"	3 3 6	8	9	20	T "
186	"	"	"	2 5 12	16	19	25	" "
187	"	"	"	0 3 6	11	13	15	" "
188	"	"	"	0 0 1	3	5	7	" "
189	640	32	"	1 2 4	5	7	14	" "
190	"	"	"	2 1 5	7	11	16	" "
191	570	"	"	0 3 9	10	11	14	" "

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12 GAGE DESIGN

ROUND TYPE - ER 228-IV



21 PROJECTILES  
.175 SPAN  
15° FIN CANT

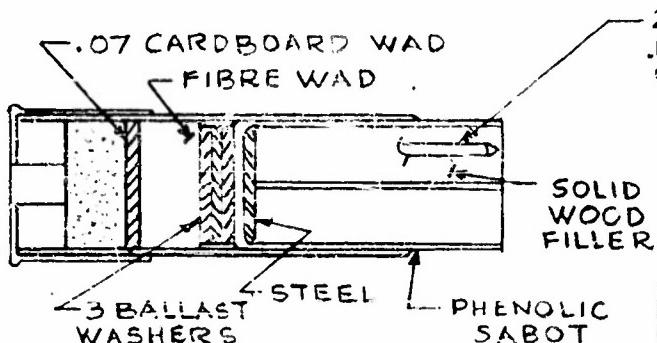
NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0	5	10	15	20
---	---	----	----	----

AVERAGE ROUND	3			
BEST ROUND	NORECORD			

TOTAL ROUNDS FIRED - 3

ROUND TYPE - ER 228-V



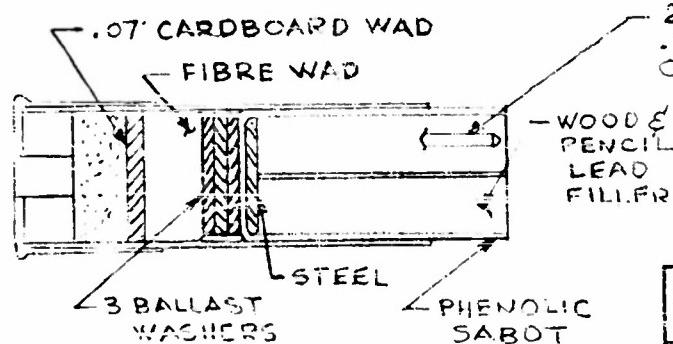
21 PROJECTILES  
.175 SPAN  
0° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	8			
BEST ROUND	8			

TOTAL ROUNDS FIRED - 1

ROUND TYPE - △ I



21 PROJECTILES  
.175 SPAN  
0° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	5.5			
BEST ROUND	6			

TOTAL ROUNDS FIRED -

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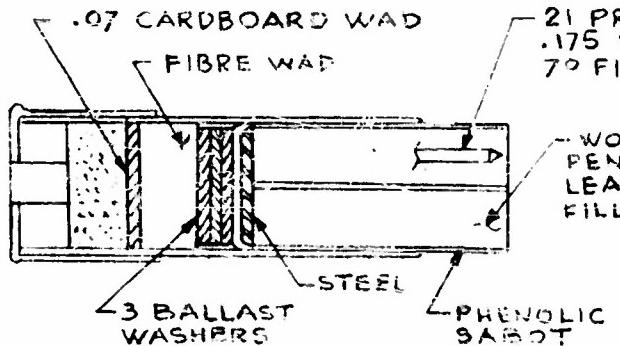
AIRCRAFT  
ARMAMENTS  
INC.

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12 GAGE SHOTGUN

ROUND TYPE - ΔII

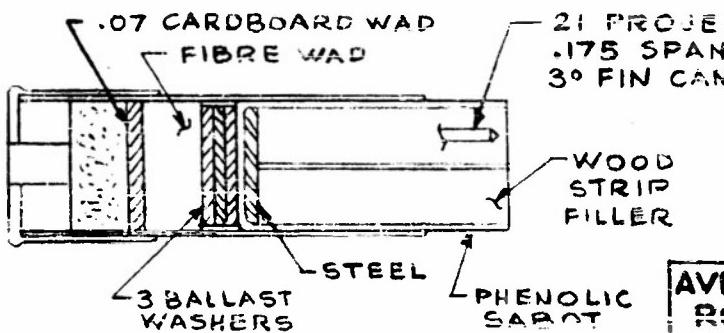


TOTAL ROUNDS FIRED - 2

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND				10.5	
BEST ROUND			11		

ROUND TYPE - □

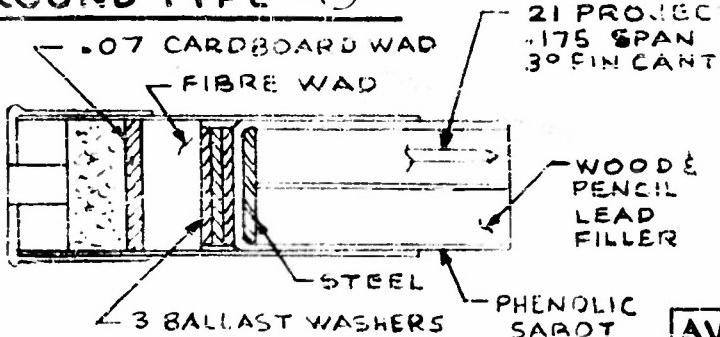


TOTAL ROUNDS FIRED - 4

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
C 5 10 15 20

	C	5	10	15	20
AVERAGE ROUND				12.7	
BEST ROUND				17	

ROUND TYPE - ○



TOTAL ROUNDS FIRED - 3

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

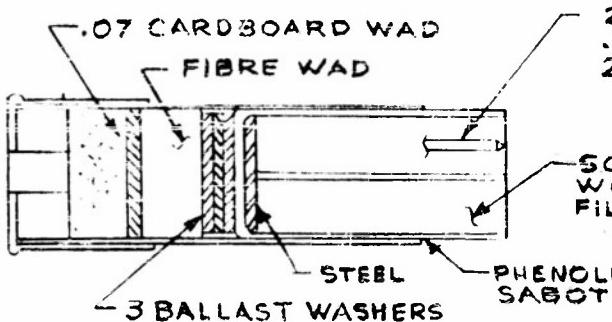
	0	5	10	15	20
AVERAGE ROUND				17	
BEST ROUND				17	

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12 GAGE SHOTGUN

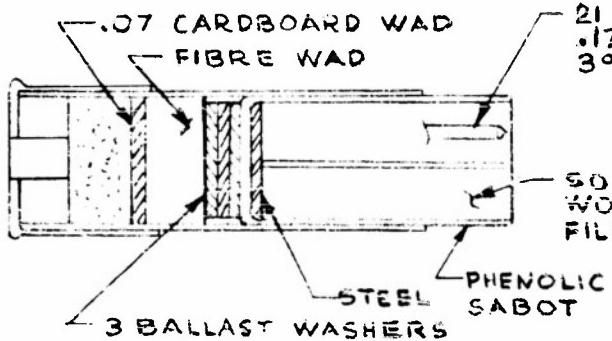
ROUND TYPE - ER 228 I



TOTAL ROUNDS FIRED - 9

		NO. OF PROJECTILES IN 6 FT. DIA. AT 100 YDS.				
		0	5	10	15	20
AVERAGE ROUND	BEST ROUND	6				
		7				

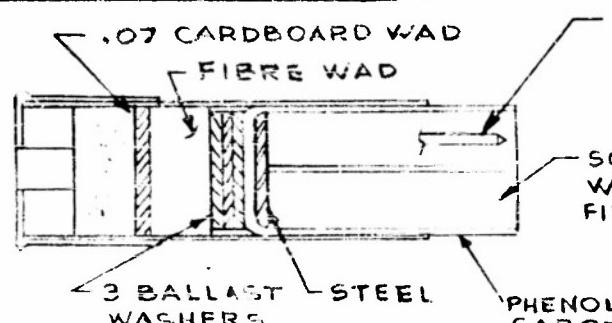
ROUND TYPE - ER 228 II



TOTAL ROUNDS FIRED - 49

		NO. OF PROJECTILES IN 6 FT. DIA. AT 100 YDS.				
		0	5	10	15	20
AVERAGE ROUND	BEST ROUND	7.5				
		14				

ROUND TYPE - ER 228 III



TOTAL ROUNDS FIRED - 7

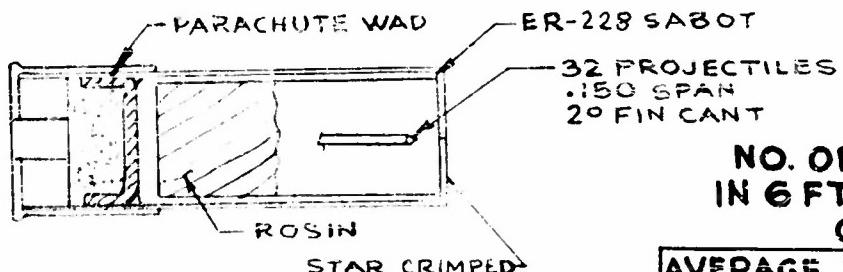
		NO. OF PROJECTILES IN 6 FT. DIA. AT 100 YDS.				
		0	5	10	15	20
AVERAGE ROUND	BEST ROUND	4.7				
		10				

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ROUND TYPE - R



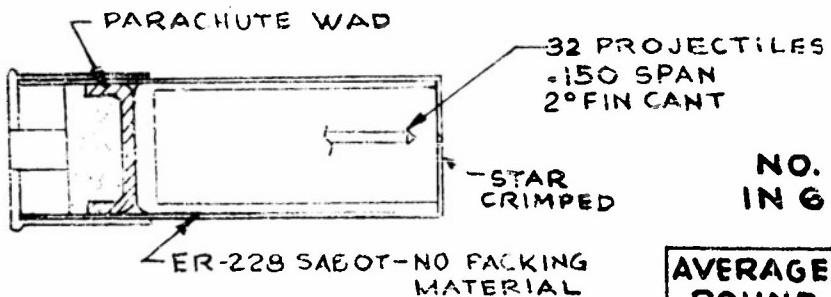
NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	[REDACTED]	5.5		
BEST ROUND	[REDACTED]	7		

TOTAL ROUNDS FIRED - 2

ROUND TYPE - S



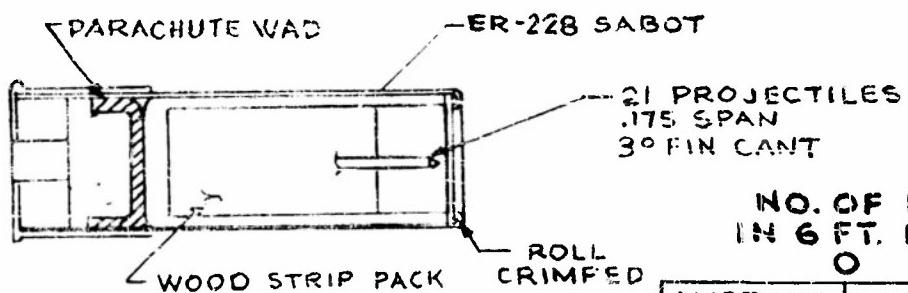
NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	[REDACTED]	4		
BEST ROUND	[REDACTED]	4		

TOTAL ROUNDS FIRED - 1

ROUND TYPE - QI



NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	[REDACTED]	4.5		
BEST ROUND	[REDACTED]	5		

TOTAL ROUNDS FIRED - 2

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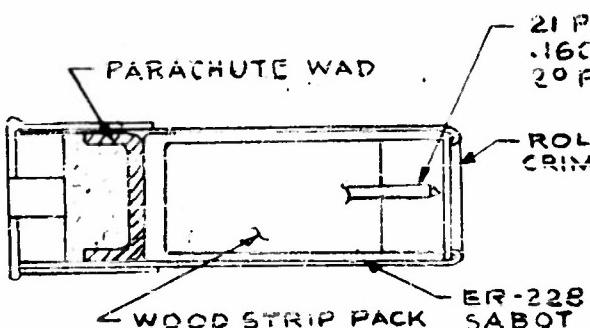
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ARMAMENTS  
INC.**

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12 GAGE SHOTGUN

ROUND TYPE - QII

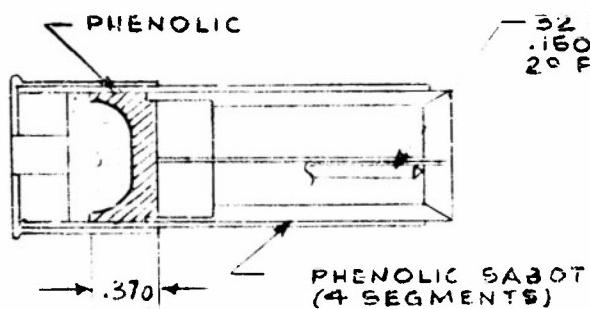


TOTAL ROUNDS FIRED - 2

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	[REDACTED]	55		
BEST ROUND	[REDACTED]	10		

ROUND TYPE - A

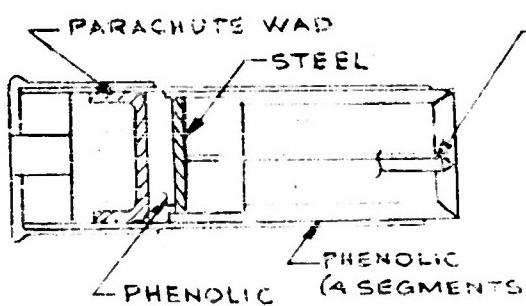


TOTAL ROUNDS FIRED - 6

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

AVERAGE ROUND	[REDACTED]	6.7		
BEST ROUND	[REDACTED]	8		

ROUND TYPE - E



TOTAL ROUNDS FIRED - 8

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.  
0 5 10 15 20

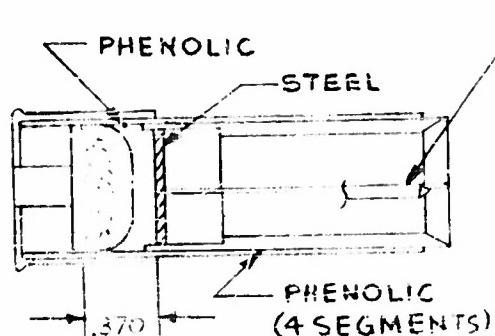
AVERAGE ROUND	[REDACTED]	3.1		
BEST ROUND	[REDACTED]	6		

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12 GAGE SHOTGUN

ROUND TYPE - B



32 PROJECTILES  
.160 SPAN  
2° FIN CANT

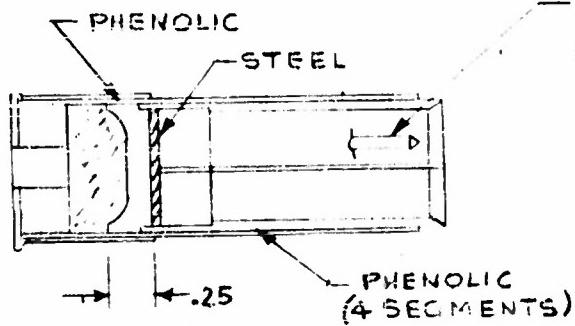
TOTAL ROUNDS FIRED - 8

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	[REDACTED]	6.5		
BEST ROUND	[REDACTED]	11		

ROUND TYPE - C



32 PROJECTILES  
.160 SPAN  
2° FIN CANT

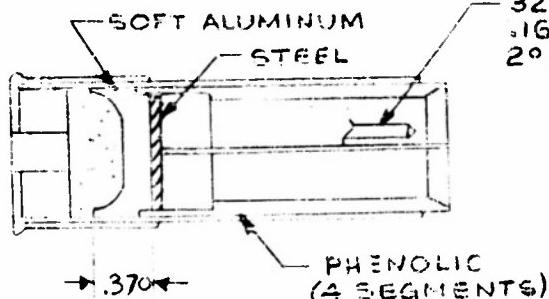
TOTAL ROUNDS FIRED - 8

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	[REDACTED]	4.6		
BEST ROUND	[REDACTED]	13		

ROUND TYPE - D



32 PROJECTILES  
.160 SPAN  
2° FIN CANT

TOTAL ROUNDS FIRED - 12

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

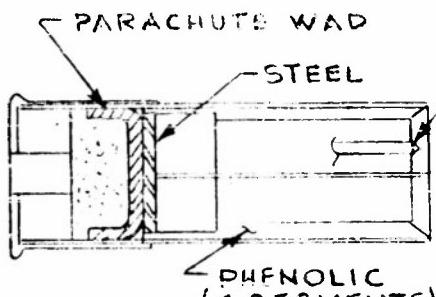
AVERAGE ROUND	[REDACTED]	7		
BEST ROUND	[REDACTED]	19		

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10 GAGE SHOTGUN

ROUND TYPE - F



TOTAL ROUNDS FIRED - 1

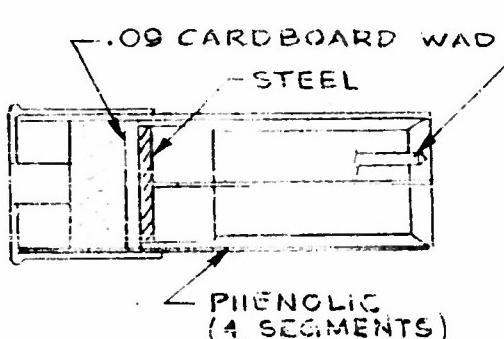
32 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	2			
BEST ROUND	2			

ROUND TYPE - G



TOTAL ROUNDS FIRED - 1

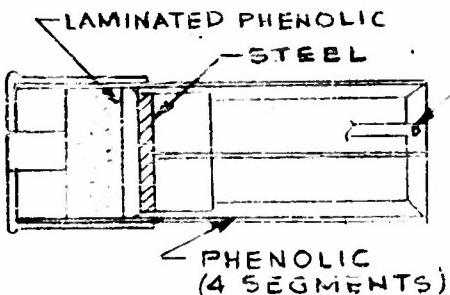
32 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	8			
BEST ROUND	8			

ROUND TYPE - H



TOTAL ROUNDS FIRED - 1

32 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

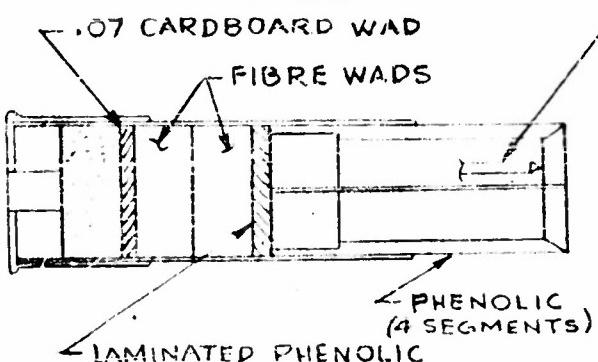
AVERAGE ROUND	10			
BEST ROUND	10			

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12 GAGE SHOTGUN

ROUND TYPE-J



TOTAL ROUNDS FIRED - 2

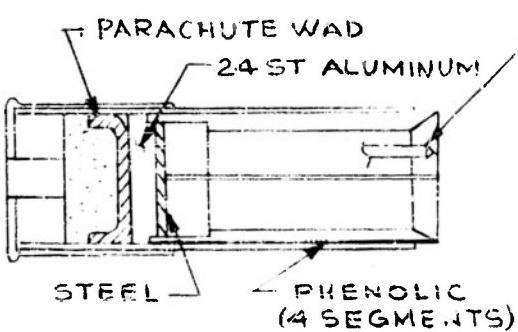
32 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0	5	10	15	20
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AVERAGE ROUND	[redacted]	[redacted]	13.5	[redacted]
BEST ROUND	[redacted]	[redacted]	16	[redacted]

ROUND TYPE - K



TOTAL ROUNDS FIRED - 3

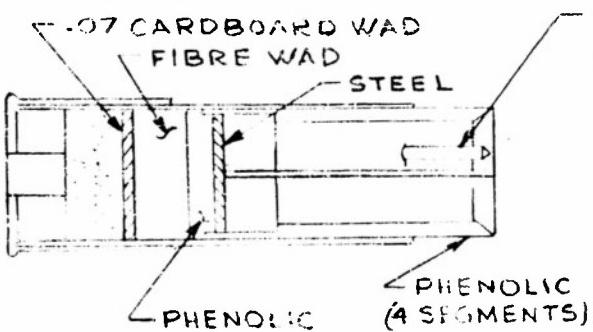
32 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0	5	10	15	20
---	---	----	----	----

AVERAGE ROUND	[redacted]	5	[redacted]	[redacted]
BEST ROUND	[redacted]	5	[redacted]	[redacted]

ROUND TYPE - L



TOTAL ROUNDS FIRED - 6

32 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0	5	10	15	20
---	---	----	----	----

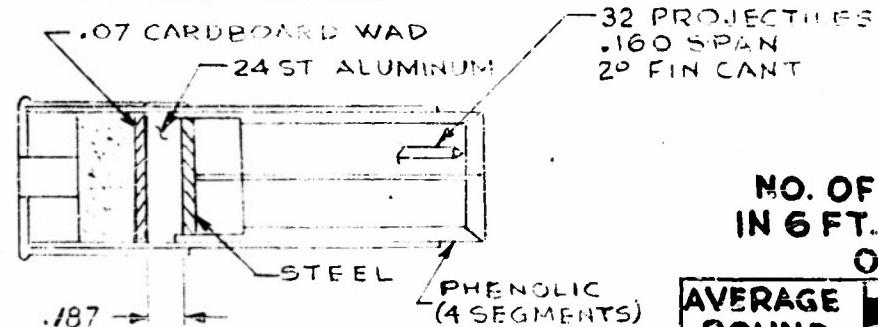
AVERAGE ROUND	[redacted]	3.7	[redacted]	[redacted]
BEST ROUND	[redacted]	10	[redacted]	[redacted]

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12 GAGE SHOTGUN

ROUND TYPE - M



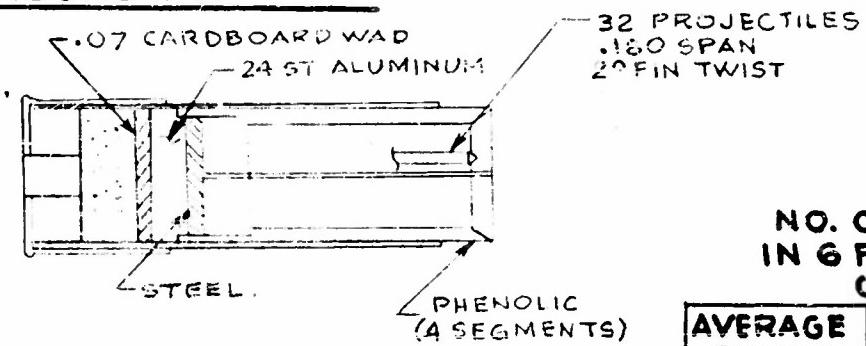
TOTAL ROUNDS FIRED - 3

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	53			
BEST ROUND	9			

ROUND TYPE - N



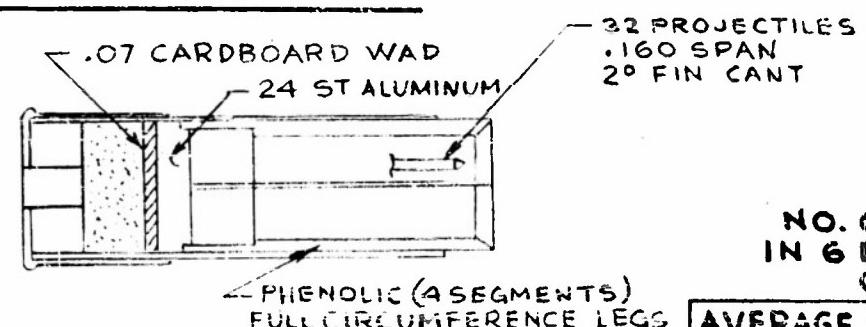
TOTAL ROUNDS FIRED - 3

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	6			
BEST ROUND	8			

ROUND TYPE - PI



TOTAL ROUNDS FIRED - 9

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

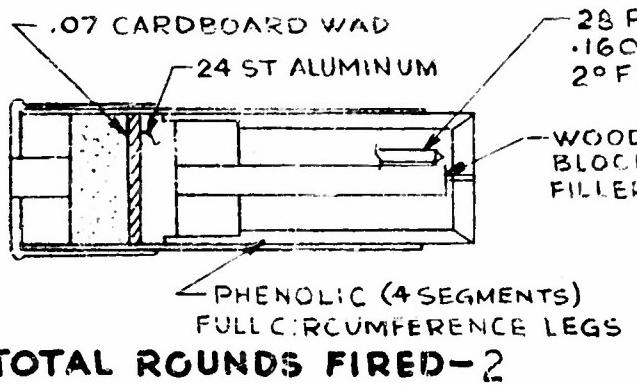
AVERAGE ROUND	7.7			
BEST ROUND	11			

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ROUND TYPE - PII



TOTAL ROUNDS FIRED - 2

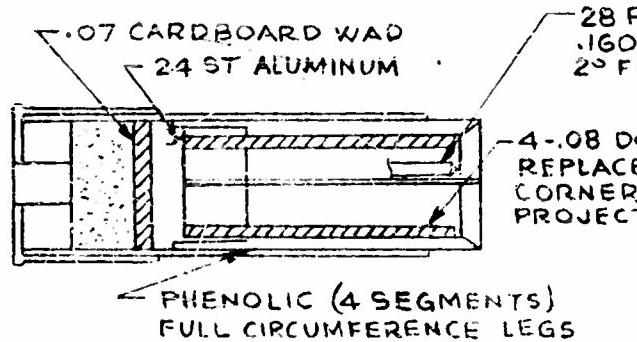
28 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0	5	10	15	20
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AVERAGE ROUND	6.5			
BEST ROUND	7			

ROUND TYPE - T



TOTAL ROUNDS FIRED - 4

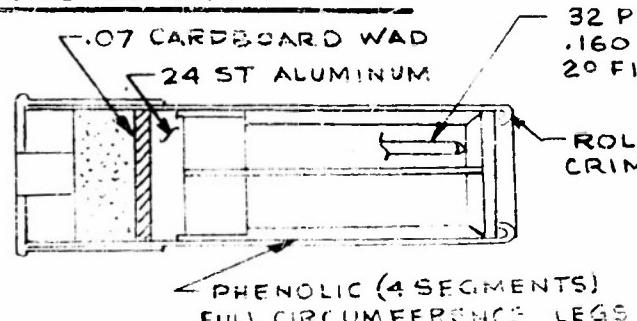
28 PROJECTILES  
.160 SPAN  
2° FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0	5	10	15	20
---	---	----	----	----

AVERAGE ROUND	54			
BEST ROUND	52			

ROUND TYPE - U



TOTAL ROUNDS FIRED - 2

32 PROJECTILES  
.160 SPAN  
20 FIN CANT

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

0	5	10	15	20
---	---	----	----	----

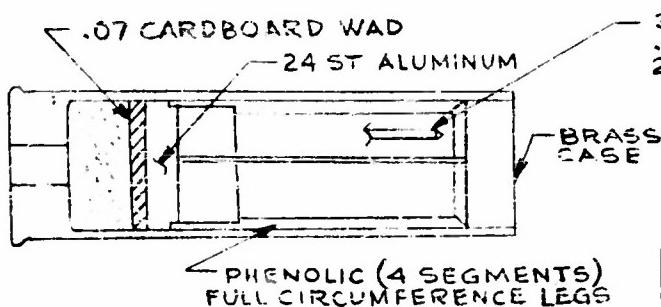
AVERAGE ROUND	4			
BEST ROUND	5			

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12 GAGE SHOTGUN

ROUND TYPE-V



TOTAL ROUNDS FIRED - 2

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			8		
BEST ROUND		7			

ROUND TYPE-

TOTAL ROUNDS FIRED -

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND					
BEST ROUND					

ROUND TYPE-

TOTAL ROUNDS FIRED -

NO. OF PROJECTILES  
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND					
BEST ROUND					

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